363656

RECORD OF DECISION

BERKLEY PRODUCTS SUPERFUND SITE

West Cocalico Township, Pennsylvania

RECORD OF DECISION
BERKLEY PRODUCTS

DECLARATION

SITE NAME AND LOCATION

Berkley Products Company Dump Site
Denver, Pennsylvania

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Berkley Products Site (the Site) which was chosen in accordance with the Comprehensive Environmental Response Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (CERCLA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

The Commonwealth of Pennsylvania concurs with the Selected Remedy set forth in this Record of Decision.

ASSESSMENT OF THE SITE

Pursuant to duly delegated authority, I hereby determine pursuant to Section 106 of CERCLA, 42 U.S.C. §9606, that actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The elements of the selected remedy are described below and are the only planned actions for the Site.

1. Pre-design investigations

2. Site preparation and Consolidation of landfill wastes

3. Site grading

4. Cover system with the following components as determined necessary for compliance with the relevant sections of Pennsylvania's Hazardous Waste Regulations:
   - Subgrade
   - Gas vent system
   - Barrier layers
   - Drainage layer
   - Top layer (vegetated)

5. Security fencing

6. Erosion control measures

7. Institutional controls restrict new well installation in the contaminated zone

8. Long-term operation and maintenance

9. Groundwater, surface runoff, leachate spring and seep monitoring (annual), residential well monitoring (semi-annual) and monitoring wells (quarterly)

10. Five-year reviews.

STATUTORY DETERMINATIONS

I hereby determine that the selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technology, to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces the toxicity, mobility or volume as a principal element.

Because this remedy will result in hazardous substances remaining on-site, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Thomas C. Voltaggio, Director
Hazardous Waste Management Division
U.S. EPA, Region III

6/28/91
Date

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DECISION SUMMARY

RECORD OF DECISION
BERKLEY PRODUCTS SITE
DECISION SUMMARY

I. SITE NAME, LOCATION AND DESCRIPTION

The Berkley Products Superfund Site ("the Site") is located one and a half miles northeast of Denver, Pennsylvania, in West Cocalico Township, Lancaster County (Figure 1). Also known as Schoeneck Landfill, the Site is east of Wollups Hill Road, north of Swamp Bridge Road. The Site is a former "town dump" which covers about five acres on the crest of a hill, within a larger tract of 21 acres. The Site includes the landfill, areas where dumping occurred on the southern slope and the groundwater affected by contamination leaching from the landfill. The area surrounding the Site is primarily forested residential.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Site was used as a municipal waste dump from approximately 1930 until 1965. In 1965, the Lipton Paint Company ("Lipton"), a subsidiary of Berkley Products Company, purchased the property. The operation continued to receive household trash from neighboring communities as well as paint wastes from Berkley Products Company. The property was closed by Lipton due to a lack of available fill area and cover material, and covered with soil. Then, in September 1970, the property was sold to private owners and has been used as a residence since.

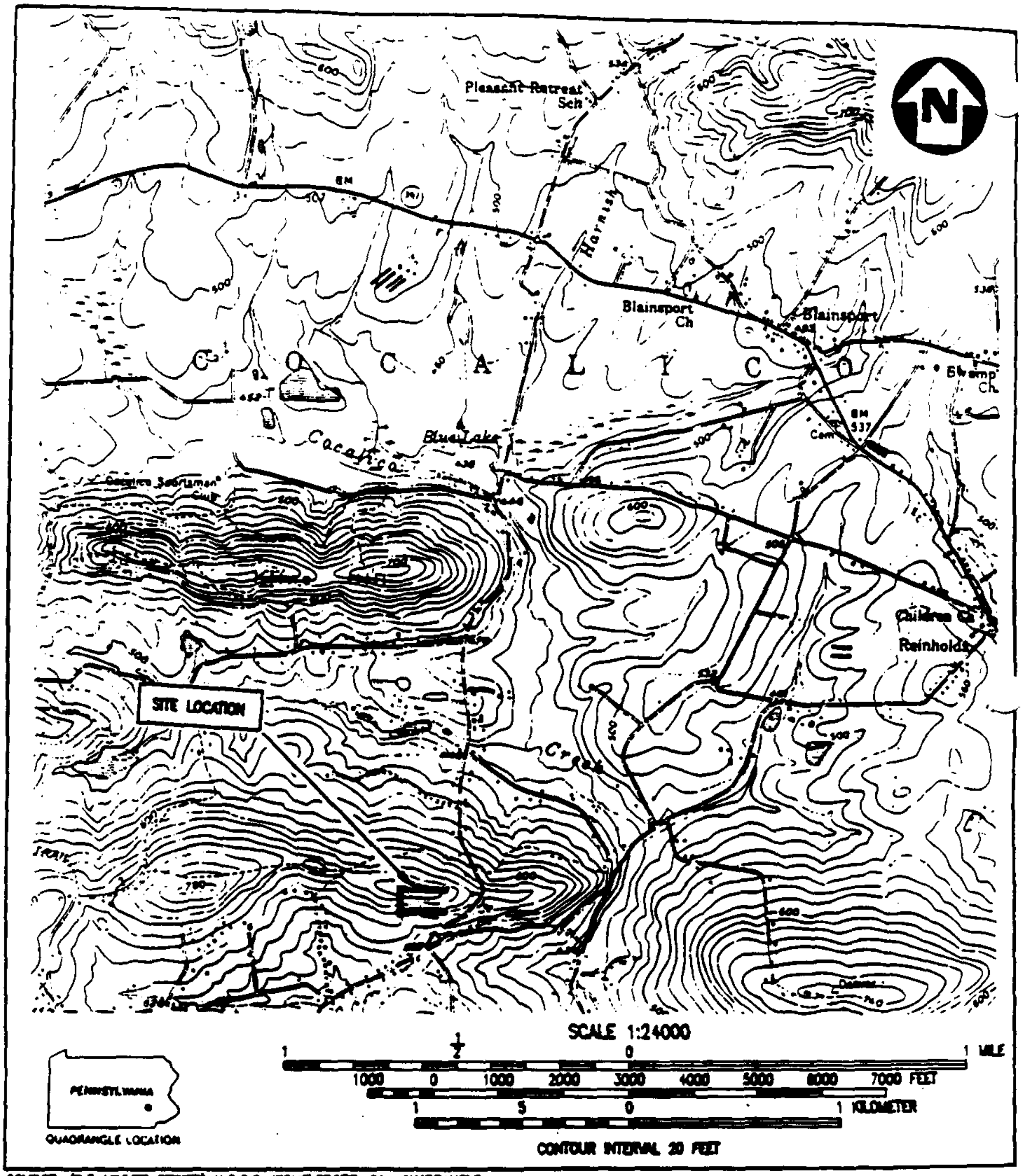
Prior to 1965, the dump received paper, wood, cardboard and other domestic trash from the northeastern corner of Lancaster County. The only commercial wastes identified during that period were from local shoe companies. Those wastes included leather scraps and empty glue and dye pails.

During the period from 1965 to 1970, different sources estimate that the dump received from 650 to 40,000 gallons of paint wastes from Berkley Products Company. These wastes included primarily pigment sludges and wash solvents. EPA has learned that the solvents were sometimes used to burn the household trash and that the sludges were disposed of in five gallon pails. Information gathered about the final years of operation of the Site indicates that the municipal trash was dumped to the south of the access road, toward the hillside, while the paint wastes were deposited in the northern part of the dump.

The Berkley Products Company produced paints and varnishes with solvents, ethyl cellulose resin and pigments with lead oxide and lead chromate. The solvents included toluene, xylene, aliphatic naphthas, mineral spirits, methyl ethyl ketones, methyl isobutyl ketones, ethyl acetate, butyl acetate, glycol ether, butyl celasol, methyl alcohol and isopropyl alcohol.

This Site was originally investigated by the Pennsylvania Department of Environmental Resources (PADER) in 1984. In March of that year, PADER completed a "Potential Hazardous Waste Site Identification" form and the Site was included on EPA's CERCLIS, a list of potentially hazardous waste sites. A "Preliminary Assessment" was also completed in 1984, by EPA, and the Site was scheduled for further investigation pursuant to the Comprehensive Environmental Response, Compensation and Liability Act, as amended, (CERCLA), 42 U.S.C. §§9601 - 9675.

In July 1984, EPA collected field samples that were presented in a "Site Investigation" report dated March 5, 1986. The information from the Site Investigation was used to score the Site using the



SOURCE: (7.5 MINUTE SERIES) U.S.G.S. WOMELSDORF, PA., QUADRANGLE
EPA DRAFT III 1985

FIGURE 1

SITE LOCATION MAP
BERKLEY PRODUCTS CO. DUMP SITE, DENVER, PA
(SCALE 1:24000)

Hazard Ranking System. The Site was nominated for the National Priorities List (NPL) of Superfund sites in 1986 with a score of 30.00 and was finalized as an NPL site in March 1989. The regulations enacted pursuant to CERCLA generally require that a Remedial Investigation and Feasibility Study (RI/FS) be conducted at each NPL site and subsequently, a remedial response action selected to address the problems identified.

During the search for parties potentially responsible for the Site ("Potentially Responsible Parties" or PRPs), EPA conducted interviews with former owners, operators and employees of the Site. Company records were also obtained and deed information was researched. That information has been compiled and reviewed to determine liability and also to estimate types and quantities of wastes disposed at the Site and to determine disposal practices during operations. Based on the findings of the PRP search, EPA sent Notice Letters to two parties, Berkley Products Company and the landowner that had purchased the closed landfill. These Notice Letters identified the parties as PRPs, but waived the sixty day moratorium, established at CERCLA Sections 122(a) and 122(e), to negotiate a Consent Order to perform the RI/FS. This waiver was issued pursuant to CERCLA Section 122(a).

EPA initiated the RI/FS in 1990 to identify the types, quantities and locations of contaminants, to evaluate the potential risks, and to develop and evaluate remedial action alternatives to address the contamination problems at this Site. A CERCLA removal action was taken at the Site in October 1991 to address some preliminary findings of the RI. During the field investigation of the RI, buried drums containing paint wastes were uncovered in the northeastern portion of the Site. This area was excavated, and 59 drums were overpacked and removed. Seven drums were overpacked and removed from the southern slope of the landfill. An additional 35-foot-long by 15-foot-deep exploration trench uncovered no additional drums. A total of 67 drums were removed from the Site. The wastes were classified as PCB flammable liquids, solids, and paint solvents.

The field investigations, data analysis and evaluation of alternatives that comprise the RI/FS have now been completed for the Berkley Products Site.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The information summarized in this Record of Decision (ROD) is available at the public information repository for this project that has been established by EPA at the West Cocalico Township Office located at the:

West Cocalico Township Office
156B West Main Street
Reinholds, Pennsylvania
(717) 336-8720

EPA encourages the public to review these collected documents in order to get a better understanding of the Site and the Superfund activities that have been conducted there.

EPA solicited input from the community on the cleanup plans and methods in the Proposed Plan. A formal public comment period for the Proposed Plan lasted from April 8, 1996 to May 7, 1996. This comment period included a public meeting held on April 17, 1996 at the West Cocalico Township Office. At this meeting, EPA presented the results of the RI/FS and discussed EPA's Proposed Plan and Preferred Alternative for remediation of the Site.

EPA accepted written comments throughout the comment period and oral comments at the public meeting. The major and significant public comments that EPA received on the Proposed Plan are summarized and addressed in the <u>Community Acceptance</u> discussion contained in Section VIII,

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES, and presented in more detail in the Responsiveness Summary included as Attachment 1 of this ROD.

IV. SCOPE AND ROLE OF RESPONSE ACTION

In 1991 a removal action was conducted at the Site to address the buried drums discovered during the RI. The drums were excavated and removed as a "principal threat", an area of highly concentrated waste that could be removed to quickly reduce or prevent the continued migration of contamination.

The response action described in this Record of Decision will comprehensively address the threats posed by the remainder of the Site. This ROD addresses the landfill which is the source of contamination and the potential migration of contaminants at the surface and in the groundwater to provide overall protection of human health and the environment. This response action is described in Section IX, SELECTED REMEDY.

V. SITE CHARACTERISTICS

The Berkley Products Site is located on the United States Geologic Survey (U.S.G.S.) 7.5 minute series topographic map for Womelsdorf, Pennsylvania (see Figure 1). The topography of the area is characterized by rolling plains, with elevations generally ranging between 400 and 700 feet above mean sea level (MSL). Higher ridge tops can reach 1,200 feet above MSL. The region is dissected by a mature, dendritic drainage pattern. The Site is located on the tail of the east-west-trending Furnace Hills ridge. Elevations on Site range between 540 feet above MSL along Swamp Bridge Road to about 640 feet in the landfill area. Landfilling activities on Site have altered the original topographic surface somewhat. These effects are most pronounced in the main dump area approximately 400 feet east of Wallups Hill Road.

The ridge continues to rise west of the Site to 780 feet above MSL, approximately 0.8 mile west of the Site. Topography falls rapidly south and east of the Site and more gently to the north. The elevation of Cocalico Creek, approximately 1,000 feet east of the Site, is about 435 feet above MSL (U.S.G.S., 1977). Cocalico Creek is a perennial stream that flows southward past the Site. The stream's headwaters are approximately 1.5 miles west and north of the Site at about 580 feet above MSL. In this upstream area, Cocalico Creek is classified by the Pennsylvania Department of Environmental Protection (PADEP) as a high-quality, warm-water fishery (Pennsylvania Code, Title 25, 1991).

The Berkley Products Site lies within the Triassic Lowlands Section of the Piedmont Physiographic Province. This section is expressed as an uplifted plain formed of relatively soft, red sandstone and shale. Higher ridges mark the locations of lenses of hard quartz conglomerate or of sheets or dikes of dense igneous intrusive rock (Geyer & Boles, 1987).

The Triassic age rocks of the region lie within the Newark Gettysburg Basin. Sedimentary rocks along the south and southeast margin of the Newark Gettysburg Basin rest on an erosional contact with the older structural complex of Lower Paleozoic quartzites and carbonates and locally upon Precambrian gneiss, granite, and metabasalt. Sediments in the basin dip to the north and northwest in a simple, homoclinal structure. A major fault system occurs along the northern margin of the basin. Downward movement along this fault system formed the basin complex. Minor cross faulting offset some of the rock layers.

Bedrock beneath the Site is composed of interbedded units of sedimentary rock including conglomerate, sandstone, siltstone, and shale. Collectively, these units are referred to as the Gettysburg Formation (Richardson, 1990; Glaeser, 1966). An intrusive diabase dike is also present in the area. The various sedimentary layers of the Gettysburg Formation were laid down as sheets or beds in ancient meandering stream, river, and lake environments and are differentiated into bedding planes. These bedding planes have been rotated over time into an east-west orientation with an approximately 35 degree dip to the north. Some of the bedding planes have separated into bedding plane fractures. Oriented perpendicularly to the bedding planes are joint cracks that interconnect the bedding plane fractures. The degree of jointing is dependent on the thickness and brittleness of the sedimentary beds.

Siltstone and sandstone are the dominant rock types regionally, although they underlie only about 35 percent of the landfilled area of the Site. Grain size ranges from very fine to coarse. Color varies from brown to light gray, with red and brown being the most frequently encountered colors during drilling at the Site. Siltstones and sandstones are composed principally of angular to subrounded colorless quartz grains. The degree of sorting of the sandstones and Siltstones decreases with increasing grain size. These units are moderately well bedded, with thin to flaggy beds. Joints are moderately developed and abundant and are both open and filled with quartz, hematite, and calcite. The joints have a blocky pattern and an uneven regularity and are closely spaced (Geyer & Wilshusen, 1982).

The quartz conglomerate members of the Gettysburg Formation underlie approximately 60 percent of the landfilled portion of the Site, predominantly along the top of the ridge at the Site's northern edge. The conglomeratic members are composed of pebbles and cobbles of quartz, quartzite, and sandstone. The conglomerates are densely to sparsely distributed in bands and lenses ranging from 1 to 2 inches to many feet in thickness. Cobbles up to 5 to 6 inches in diameter occur in some of the thickest beds. The conglomerates are usually thick bedded and occasionally massive. They are well cemented, with some interbedding with minor beds of sandstone. The sandstone beds range in thickness from 1 to 2 inches to a foot or more. Joints in the conglomeratic members have a blocky pattern, are moderately developed, moderately abundant, regularly spaced, open, and steeply dipping.

The overall thickness of the Gettysburg Formation in the area is approximately 9,400 feet. The thickness of individual lithological units (e.g., shale/mudstone, siltstone, sandstone, and conglomerate) varies from 0 to more than 100 feet beneath the Site. The thickness and distribution of sandstone and mudstone are variable throughout the Site. The top soil is composed of silty to sandy clay. The thickness of top soil in the study area varies from 0 to 5 feet.

A north-south-trending diabase dike cuts across the lithology underlying the Site, mostly west of the landfill area. This unit underlies approximately five percent of the known landfill area. The diabase is dark gray to black, dense, and very fine grained. It consists of 90 to 95 percent labradorite and augite minerals. Joints have a blocky pattern, are well developed, moderately abundant, regularly and moderately spaced, open, and steeply dipping. Where the dike contacts the Gettysburg Formation, the sedimentary rocks have been thermally metamorphosed to a dark purple to black argillite. Thermal metamorphism may extend to a distance of several feet (Geyer & Wilshusen, 1982; Glaeser, 1966). Fracturing in the Gettysburg Formation may be locally enhanced by the intrusion of the diabase.

The main tectonic feature in the vicinity of the Site is an east-west fault. This is a reverse fault located approximately 0.3 mile north of the Site (Glaeser, 1966; Richardson 1990). This tectonic movement may have caused the displacement of the north-south diabase dike. An additional complex of reverse faults are 1.0 mile west of the Site. EPA's Environmental Photographic Interpretation Center

(EPIC) performed a fracture-trace analysis of aerial photographs in the Site vicinity. Fracture traces are linear surface features that may represent the surface expression of large regional fractures systems. No fractures traces were found to be on Site (Richardson, 1990).

Groundwater flow in the bedrock aquifer is primarily restricted to movement along the bedding-plane fractures and joints. The intergranular porosity, where present, also contributes to groundwater movement and storage but contributes more to the storativity of the aquifer than to flow. Wells in the Gettysburg Formation in Lancaster County range in depth from 43 to 235 feet, with a median depth of 105 feet. In general, the well yields in the bedrock are a function of the density of joints penetrated by the well. The yields of these wells range from 5 to 94 gallons per minute (gpm), with a median yield of 16 gpm.

Although no known wells are installed in the diabase in the study area, data are available for wells in the diabase in other areas of Lancaster County. Those wells range in depth from 27 to 400 feet, with a median depth of 122 feet. The well yields range from 3 to 15 gpm. The median well yield is 10 gpm. The narrow metamorphosed zones directly adjacent to the diabase intrusion are anticipated to be well fractured and may contribute to high yielding wells.

Groundwater flow in the Gettysburg Formation is believed to be controlled by the combination of the bedding planes' fracture strike and dip directions. The horizontal flow direction in the bedrock aquifer at the Site is along strike to the east toward Cocalico Creek. Vertically, the flow direction is downward following the northern dip direction. These two combined flow directions impart an overall flow direction downward from the Site to the northeast. Groundwater in the area discharges to Cocalico Creek.

The Berkley Products Site is approximately 1,000 feet west of Cocalico Creek. The headwaters of Cocalico Creek are in the valley south of South Mountain near Blue Lake. This valley is located a few miles north of the Site. Conestoga Creek, along with its tributaries, Muddy Creek, Little Conestoga Creek, and Cocalico Creek, drains the northeastern and north-central portion of Lancaster County and eventually enters the Susquehanna River. Regionally, significant amounts of groundwater may be discharging into Cocalico Creek along the east-west fault plain mentioned above. Seasonally, wet springs located immediately north of the Site discharge into Cocalico Creek to the north. On the southern side of the Site, a seep is located on the slope of the landfill material. EPA believes that flow within this seeps is related to rain events.

The land use in the immediate vicinity of the Site is rural in nature. The Site is near dense woods and several single family homes. A few open areas have been converted into farm land by the local residents. During the groundwater sampling of April 1993, two new houses immediately north of landfill were sampled.

VI. NATURE AND EXTENT OF CONTAMINATION

Investigation

The nature and extent of contamination at the Berkley Products Site have been characterized during the Remedial Investigation through soil sampling during a test pitting program, multiple rounds of groundwater sampling, surface water and spring sampling, soil sampling, and leachate sediment sampling. Samples collected in 1990 and 1991 were analyzed for the full-scan Priority Pollutant List (PPL) compounds. Samples collected in 1993 were analyzed for the full scan of Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics. The TCL and TAL are more inclusive than the PPL, and all PPL compounds are included as part of a TCL/TAL analysis.

The test pitting program consisted of excavating eight test pits (TP-1 through TP-8) across the Site in March 1991 (see Figure 2). The test pits were excavated to a depth of 5 to 12 feet and were 19 to 22 feet long and 2 to 5 feet wide. Locations for the test pits were selected based on the results of geophysical and soil gas surveys. Sets of samples were collected on each end of the test pits; at the surface, at depths of 5 feet and at the deepest point of the excavation. In addition, up to two additional samples were obtained from each half of the test pit where special concerns or materials were encountered. A total of 55 soil samples were obtained from the test pits and were analyzed for a full scan of PPL. Sixteen of the 55 samples were surface soil samples. Also, two of the 55 samples were background surface and subsurface soil samples.

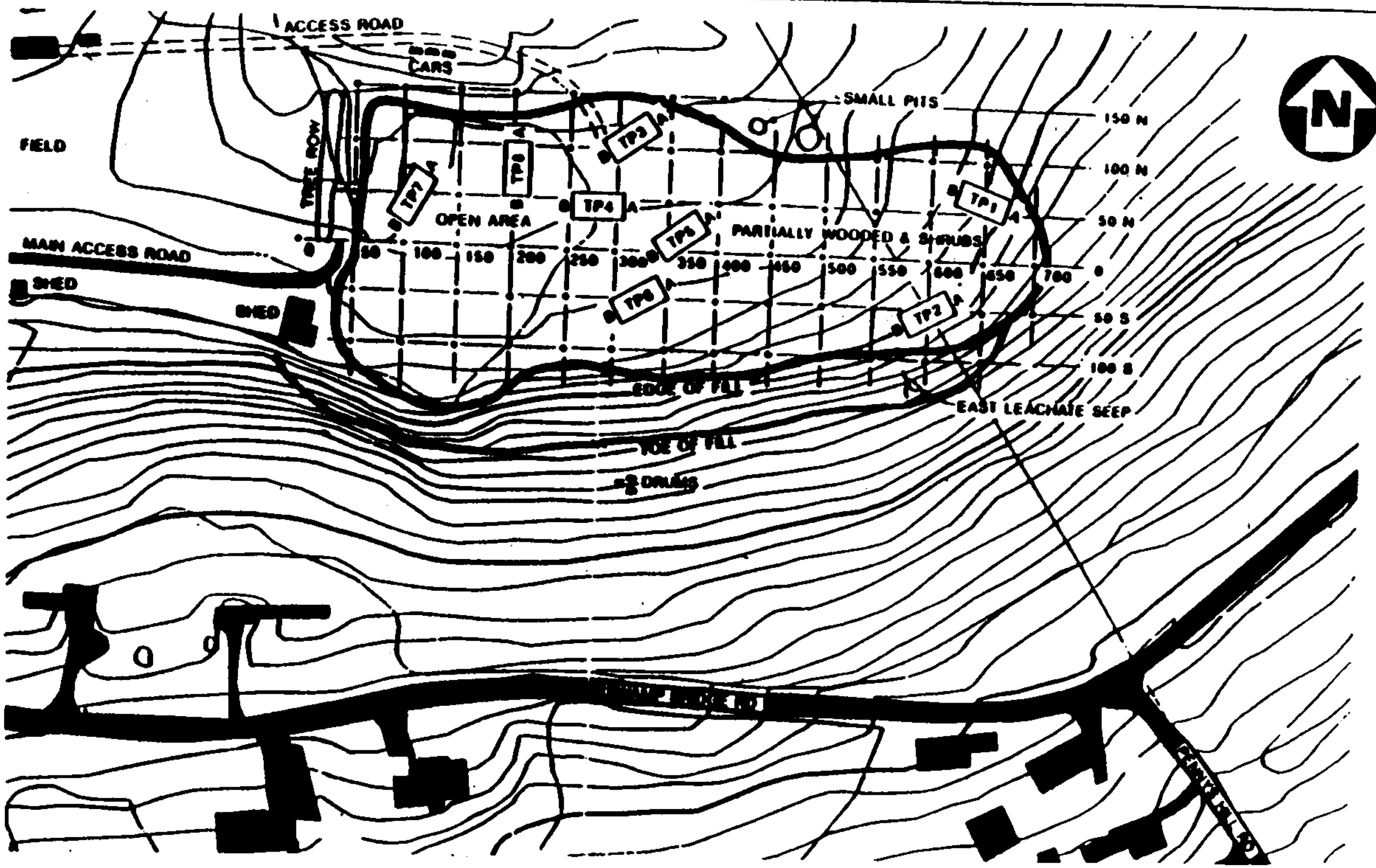
Additional soil sampling, surface water and sediment sampling, and leachate sediment sampling also occurred at the Site. Surface water/sediment samples were collected from seven locations (SW/SD-1 through SW/SD-7) along Cocalico Creek and its tributaries north, northeast, and southeast of the Berkley Products Site (Figure 3). Four additional surface water/sediment samples (SW-8/SD-8 through SW-11/SD-11) were collected from small springs located on the north-facing slope of the hill north of the landfill. Runoff from these springs ultimately discharges to Cocalico Creek.

Surface soil samples were collected from the Berkley Products Site during three separate events. During the first event, 11 soil samples (S-1 through S-11) were collected during the soil gas survey to confirm the results of the soil gas survey (see Figure 4). One of the 11 samples was from the east leachate seep, and a background soil sample was also obtained. These samples were collected from a depth of 1.5 to 3.0 feet below ground surface and were analyzed in the field using a portable gas chromatograph (GC). The confirmation soil samples were analyzed for selected volatile organics [trichloroethene (TCE), benzene, tetrachloroethene (PCE), toluene, ethylbenzene, o-xylene, styrene, and m-xylene]. During the second event, 16 surface soil samples were collected as part of the test pitting program as previously noted. The third event involved a leachate sediment sample (LD-1) from the east leachate seep and two downgradient surface soil samples (SO-1 and SO-2) in the apparent surface drainage direction from the east leachate seep (see Figure 5). These samples were analyzed for full-scan PPL.

Thirteen monitoring wells were installed in clusters at five locations during the RI at the Site (see Figure 5). Each well cluster consisted of shallow, intermediate, and deep wells (S, I and D), except for Cluster Nos. 3 and 4 which do not have a deep well. A total of 13 monitoring wells were installed. Groundwater sampling consisted of three rounds of residential well sampling and two rounds of monitoring well sampling. A total of 17 residential wells were sampled at least once during the three rounds of residential well sampling (Figure 6).

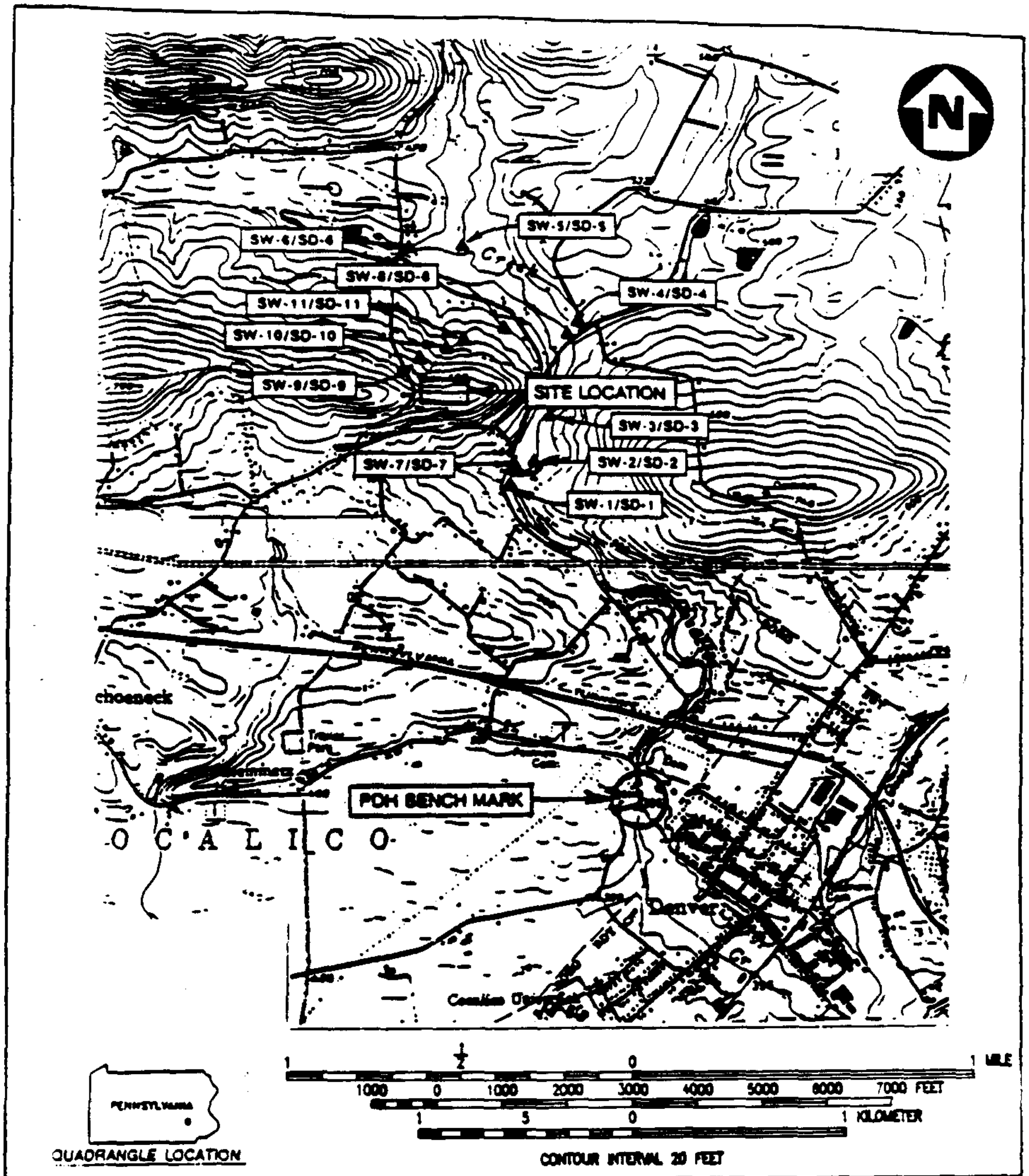
The first round of groundwater sampling in 1990 consisted of 11 samples from residential wells that were analyzed for the full-scan PPL. The second round of groundwater sampling in 1991 included 13 monitoring well samples and 8 residential well samples that were also analyzed for the full scan PPL. The third round of groundwater sampling in 1994 included 13 monitoring wells and 11 residential well samples. The third round of groundwater samples was analyzed for TCL and TAL substances. A copy of all analytical data is provided in Appendix K (Volume III) of the RI Report. Prior to the last round of groundwater sampling in 1993, EPA required that the sampling at monitoring wells at Cluster No. 4 include sampling for potential dense non-aqueous phase liquid (DNAPL). Both wells (MW-4S and MW-4I) at this cluster were sampled prior to purging for DNAPLs and after purging for routine sampling.

For evaluation and cost estimation purposes the volume of waste contained in the landfill was estimated. Using the two elements of the landfill, the plateau and toe as outlined in Figure 2, separate volumes were calculated and added together for a combined total volume estimate of 103,331 cubic yards. The estimation of the extent of the two elements of the landfill was based on aerial



SOURCE: EPA DRAFT RI 1985
NOT TO SCALE

FIGURE 2 TEST PIT LOCATION MAP
BERKLEY PRODUCTS CO. DUMP SITE, DENVER, PA

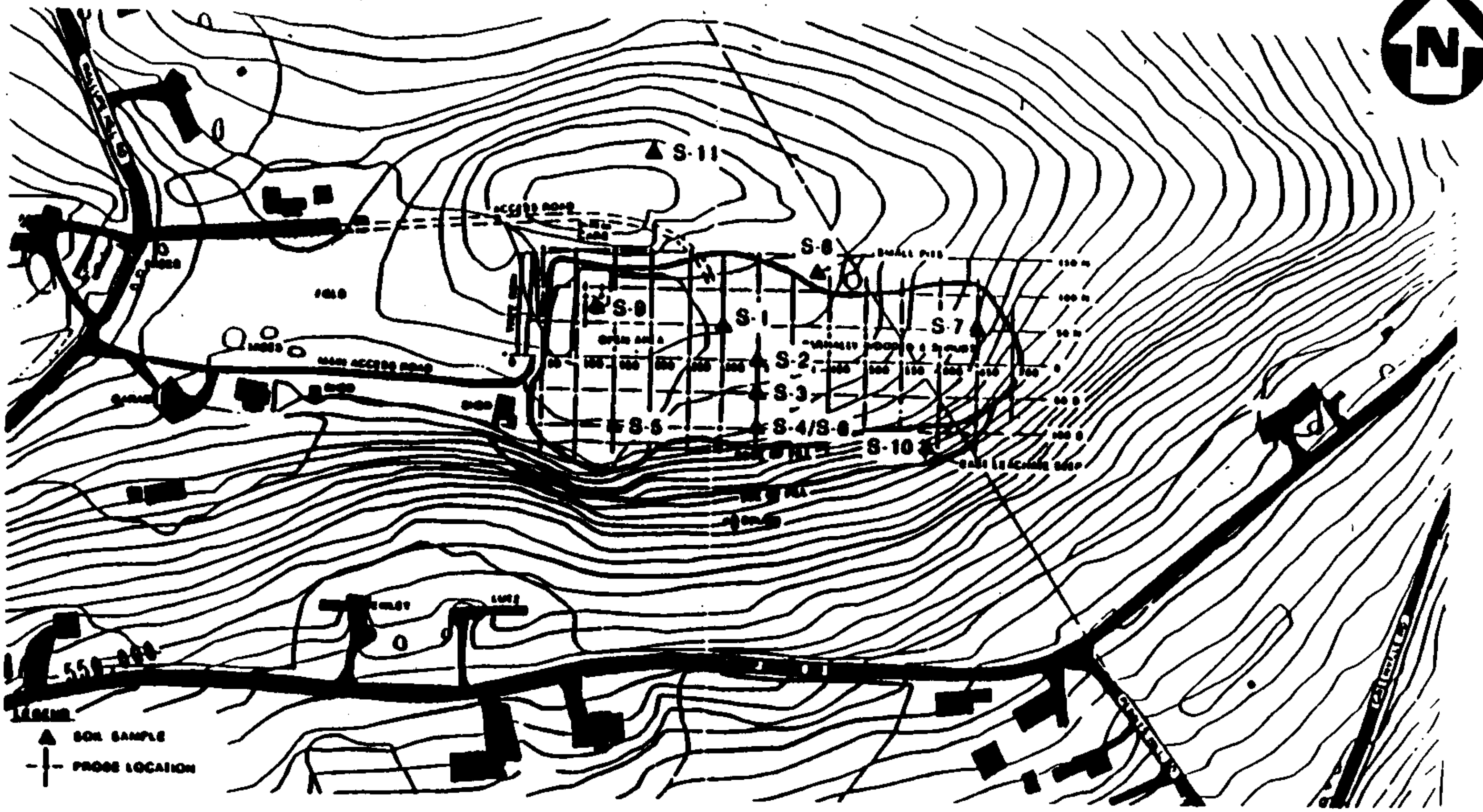


SOURCE: (7.5 MINUTE SERIES) U.S.G.S. EPHRATA & WOMELSDORF, PA., QUADRANGLES

FIGURE 3

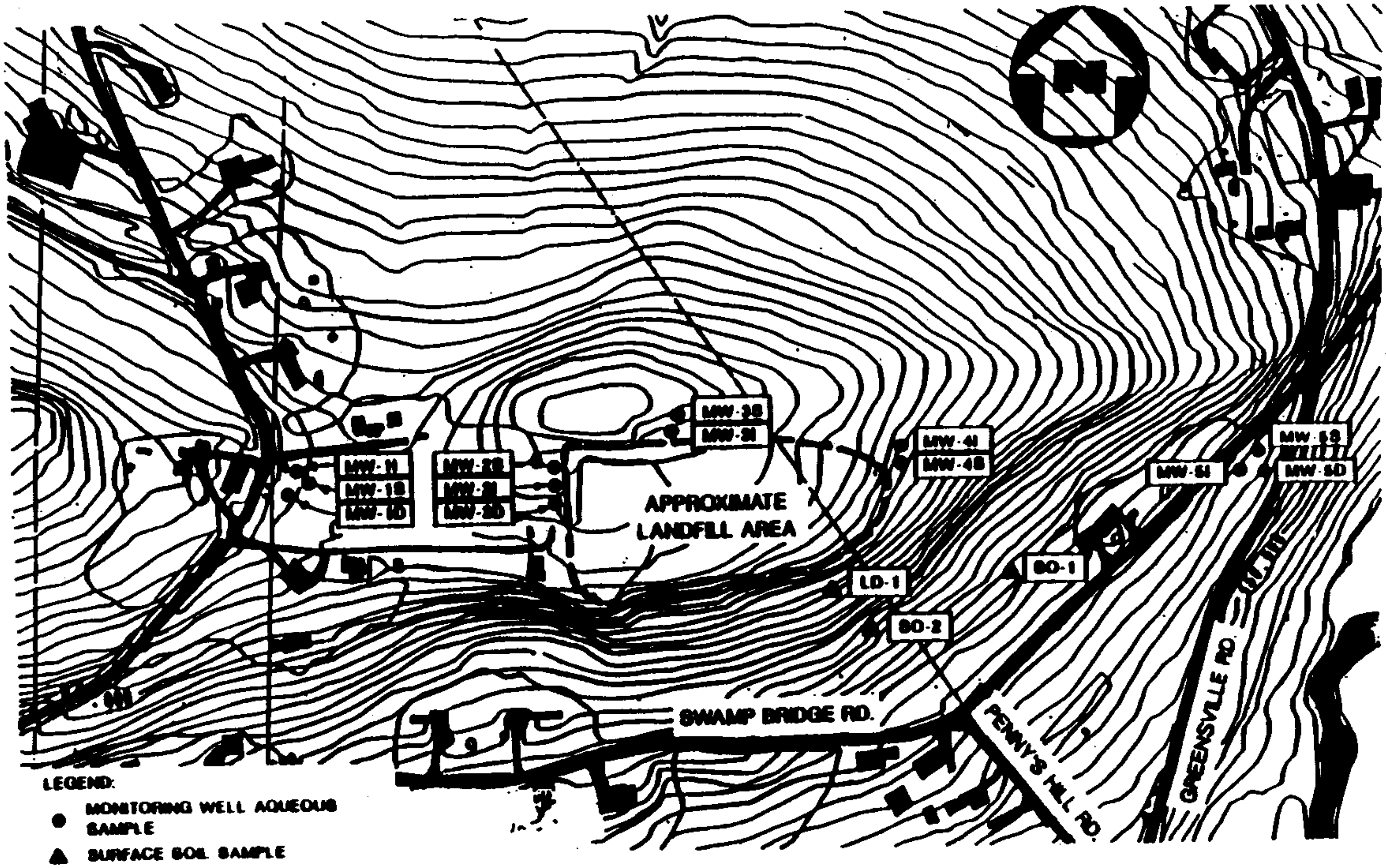
OFF-SITE SURFACE WATER/SEDIMENT SAMPLE MAP
BERKLEY PRODUCTS CO. DUMP SITE, DENVER, PA

(SCALE 1:24000)



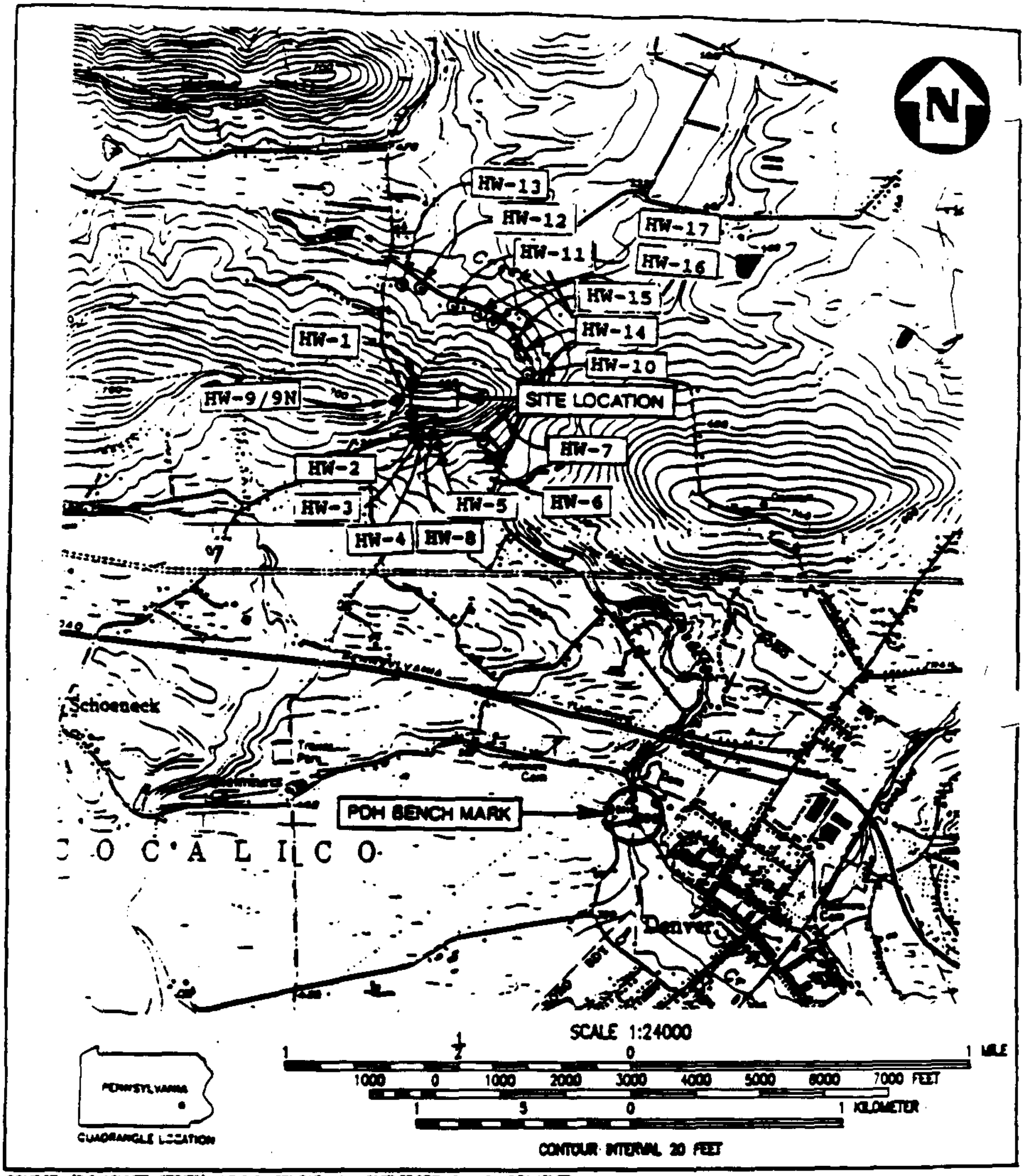
SOURCE: EPA DRAFT RI 1985
NOT TO SCALE

FIGURE 4 SOIL SAMPLE LOCATION MAP
BERKLEY PRODUCTS CO. DUMP SITE, DENVER, PA



SOURCE: EPA DRAFT RI 1985
NOT TO SCALE

FIGURE 5 SAMPLE LOCATION MAP
BERKLEY PRODUCTS CO. DUMP SITE, DENVER, PA



SOURCE: (7.5 MINUTE SERIES) U.S.G.S. EPHRATA & WOMELSDORF, PA., QUADRANGLES
EPA DRAFT RI 1986

FIGURE 6 HOME WELL SAMPLE LOCATION MAP
BERKLEY PRODUCTS CO. DUMP SITE, DENVER, PA
(SCALE 1:24000)

photographic analysis, as well as visual observations of trash on the surface, in the subsurface while auguring the boreholes for the soil gas survey, and during the test pitting operations. The surface area of the plateau of the landfilled area was estimated to be 17,055 square yards, and the southern slope - 4,700 square yards.

Results

Surface Soils

The first round of surface soil samples was analyzed for selected volatile organics (TCE, benzene, PCE, toluene, ethylbenzene, o-xylene, styrene, and m-xylene). The soil sample S-11, which is considered background, did not show any of these parameters (see Table 1). Samples S-1, S-2, S-3, and S-7 indicated detectable concentrations of volatile organics; the results from all other locations were below detection. The locations of samples S-1, S-2, S-3, and S-7 correspond to the locations of test pits TP-4, TP-5, TP-6, and TP-1, respectively.

The highest levels of most of the organic compounds were detected at sample location S-1. This location corresponds with TP-4, located in the north-central portion of the landfill. The contaminants found at S-1 included toluene (18,000 ug/kg), ethylbenzene (54,000 ug/kg), o-xylene and styrene (52,000 ug/kg), m-xylene and p-xylene (14,000 ug/kg). Other locations yielded relatively lower levels of organic contaminants. These results indicate agreement with the Site historical data and information that paint solvents were disposed in the northern area of the landfill.

The second round of surface soil samples consisted of 16 surface soil samples collected during the test pitting program and analyzed for full scan PPL. In the third round, two surface soil samples were collected downgradient of the leachate seep during the same period the surface water and sediment samples were collected and analyzed for full scan PPL.

The maximum concentrations from the 16 surface soil samples and two surface soil samples collected downgradient of the leachate seep are presented in Table 2. The results from these analyses were similar to those of the first round of sampling: Trace to low levels of volatile organics were detected in shallow soil samples (0 to 6 inches) collected from the test pit areas. TAL analysis indicated the presence of a spectrum of inorganic contaminants also present in the landfill materials.

Semivolatiles such as benz(a)anthracene, benzo(a)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl) phthalate, and chrysene were observed only in the central portion of the landfill.

Subsurface Soils

Subsurface soil samples were collected from eight test pits at depths of 5 feet or greater. From each test pit, four or more subsurface soil samples were collected. Subsurface soil samples were collected from each half of the test pit at a depth of 5 feet and 10 feet below ground surface. The collected samples were tested for TCL and TAL contaminants. Detailed descriptions of detected organic parameters are provided in Volume III, Appendix K of the EPA RI Report and are summarized in Table 3.

TABLE 1
FIELD ANALYTICAL DATA SUMMARY;
SURFACE SOIL SAMPLES (UG/KG)
BERKLEY PRODUCTS, PENNSYLVANIA

Sample Location	S-1	S-2 (DL)	S-3 (DL)	S-4	S-5	S-6	S-7 (DL)	S-8	S-9	S-10	S-11	Blank
Analyte												
TCE												
Benzene							74.00					
PCE												
Toluene	18,000.00						360.00					
Ethylbenzene	54,000.00	240	58.00									
o-Xylene and Styrene	52,000.00	280										
m-Xylene and p-Xylene	14,000.00	1200	240.00									

See Appendix D in Volume II of the EPA RI report for the complete analytical data set with qualifiers.

(DL) - Diluted analysis see referenced RI report for complete database.

TABLE 2
SURFACE SOIL DATA EVALUATION (MG/KG)
BERKLEY PRODUCTS, PENNSYLVANIA

CHEMICAL	MAXIMUM ON-SITE SURFACE	MAXIMUM BACKGROUND
Aluminum(1)	14,600	4,080
Arsenic(1)	3.3	0.7
Barium	275	36.5
Beryllium(1)	1.4	*
Cadmium		0.06
Calcium	4,000	NR
Chromium(1)	149	4.8
Cobalt	16	3.3
Copper	106	7
Iron	79,600	4,300
Lead	143	18.3
Magnesium	4,130	NR
Manganese(1)	1,970	150
Mercury	0.53	
Nickel	33.1	4.6
Potassium	1,890	NR
Silver	2.2	
Sodium	160	NR
Vanadium	29.9	
Zinc	328	19
Cyanide	10.7	
4-Methyl-2-Pentanone	1.6	
Xylenes	.057	
Ethylbenzene	.009	
2-Butanone	.17	
1,1,1-TCA	.047	
Toluene	1.1	

TABLE 2
SURFACE SOIL EVALUATION (MG/KG)
BERKLEY PRODUCTS, PENNSYLVANIA
PAGE 2 OF 2

CHEMICAL	MAXIMUM ON-SITE SURFACE	MAXIMUM BACKGROUND
PCE	.007	
TCE	.007	
Bis(2-ethylhexyl) phthalate	5.4	.528
Benzoic acid	.32	1.6
Phenol	1.8	
Acenaphthylene	.11	
Benz(a)anthracene	.44	
Benzo(a)pyrene[(1)]	.58	
Benzo(b)fluoranthene	.48	
Benzo(g,h,i)perylene	.39	
Benzo(k)fluoranthene	.34	
Chrysene	.5	
Dibenz(a,h)anthracene	.18	
Fluoranthene	.34	
Indeno(1,2,3-c,d)pyrene	.29	
Phenanthrene	.099	
Pyrene	.69	
Di-n-butyl phthalate	.036	3.034
4-Methylphenol	1	
4,4'-DDT	.049	
Dieldrin[(1)]	.049	
Aroclor 1254[(1)]	.027	

* Qualified; questionable qualitatively; unusable
NR Result not reported by laboratory
(1) Chemical of potential concern (COPC)

TABLE 3
SUBSURFACE SOIL DATA EVALUATION
BERKLEY PRODUCTS, PENNSYLVANIA

CHEMICAL	MAXIMUM CONCENTRATION (mg/kg)	LOCATION OF MAXIMUM CONCENTRATION
Acetone	2,400	TP1A5
2-Butanone	19,000	0
1,1,1-TCA	63	TP1A5
TCE	490	TP1B5
1,1,2-TCA	31	TP1B5
Benzene	87	TP1A5
4-Methyl-2-pentanone	11,000	TP1B5
PCE	450	TP1B5
Toluene	20,000	TP1B5
Ethylbenzene	1,100	TP1B5
Xylenes	4,600	TP1B5
1,2-Dichloroethene	0.012	TP3B4
Benzyl alcohol	13	TP1A4
2-Methylphenol	7.3	TP1A4
Isophorone	3.7	TP1B3
Naphthalene	11	TP1A5
Dibutyl phthalate	28	TP1B3
Bis(2-ethylhexyl) phthalate	1,300	TP6A4
4-Methylphenol	23	TP6B3
4-Chloro-3-methylphenol	0.84	TP4A2
Acenaphthylene	0.54	TP7A3
Chlorobenzene	0.055	TP8B2
Phenanthrene	4.3	TP7A3
Anthracene	0.66	TP7A3
Fluoranthene	4.5	TP7A3

TABLE 3
SUBSURFACE SOIL DATA EVALUATION
BERKLEY PRODUCTS, PENNSYLVANIA
PAGE 2 of 3

CHEMICAL	MAXIMUM CONCENTRATION (mg/kg)	LOCATION OF MAXIMUM CONCENTRATION
Pyrene	3.4	TP7A3
Butylbenzyl phthalate	0.13	TP7A2
Benz(a)anthracene	2.7	TP2A2
Chrysene	2.4	TP2A2
Benzo(b)fluoranthene	4.2	TP2A2
Benzo(k)fluoranthene	1.6	TP7A3
Benzo(a)pyrene	2.4	TP2A2
Indeno(1,2,3-c,d)pyrene	1.3	TP2A2
Benzo(g,h,i)perylene	1.4	TP2A2
Phenol	3.9	TP4B3
1,4-Dichlorobenzene	1.9	TP4A2
Benzoic acid	1.4	TP4B3
2-Methylnaphthalene	0.83	TP4A2
Dioctyl phthalate	0.46	TP8B2
Diethyl phthalate	4	TP6B4
Beta-HCH	0.046	TP1B5
Dieldrin	0.044	TP5B2
Endrin	14	TP1A6
Endosulfan II	4	TP1A6
Endosulfan sulfate	0.07	TP1B2
DDT	0.2	TP8B3
DDD	0.68	TP3A2
Aroclor 1254	140	TP1A6
Aldrin	0.053	TP4A2
DDE	0.053	TP6B4
Methoxychlor	0.35	TP3B4

TABLE 3
SUBSURFACE SOIL DATA EVALUATION
BERKLEY PRODUCTS, PENNSYLVANIA
PAGE 3 of 3

CHEMICAL	MAXIMUM CONCENTRATION (mg/kg)	LOCATION OF MAXIMUM CONCENTRATION
Endrin ketone	0.02	TP2A2
Aroclor 1248	4.6	TP6A4
Heptachlor epoxide	0.056	TP3B4
1,1-Dichloroethene	0.049	TP8B2
N-nitroso-diphenylamine	0.22	TP6A2
Dibenz(a,h)anthracene	0.31	TP7A3
Acenaphthene	0.33	TP7A3
Dibenzofuran	0.47	TP7A3
Fluorene	0.6	TP7A3
Aluminum	14,400	TP5A3
Arsenic	8	TP1A4
Barium	298	TP5A3
Beryllium	11.9	TP6B4
Cadmium	15.3	TP5B2
Chromium	538	TP5B2
Cobalt	20.5	TP2B3
Copper	237	TP5A2
Iron	101,000	TP6B3
Lead	770	TP2A3
Manganese	1,800	TP2B3
Mercury	3.1	TP5A2
Nickel	533	TP6B4
Silver	5	TP6A4
Vanadium	76.6	TP5B3
Zinc	1,950	TP2A2
Cyanide	39.5	TP1B5

Measurable levels of volatile organics were detected in all test pits. Based on the review of volatile organic data, it can be seen that the predominant area for solvent [volatile organic compound (VOC)] disposal appears to have occurred near TP-1 (northeastern corner of the landfill), and TP-6 and TP-3 (center of the landfill). TP-1 clearly indicates a "hot spot" area of a high concentration of VOCs. TP-1 consistently provided samples with the highest level of VOCs and is the area where 59 drums were excavated and removed from the Site.

The following summarizes the highest level of several VOCs (all highest levels found in TP-1):

Acetone	2,400 mg/kg
Benzene	87 mg/kg
Ethylbenzene	1,100 mg/kg
2-Butanone	19,000 mg/kg
1,1,1-TCA	63 mg/kg
1,1,2-TCA	31 mg/kg
4-Methyl-2-Pentanone	11,000 mg/kg
PCE	450 mg/kg
Toluene	20,000 mg/kg
TCE	490 mg/kg
Xylene	(Total) 4,600 mg/kg

High levels of VOCs were also found in TP-3 and TP-6. However, the detected levels were generally a magnitude or more lower than in TP-1.

Several semivolatile compounds were detected in subsurface soil samples at various locations within the landfill. The highest and most frequent detections were observed at TP-1, TP-3, TP-6, and TP-7. TP-1, TP-3, and TP-6 also have correspondingly high levels of volatile organics. TP-1 consistently showed the highest levels of Semivolatiles, which correspond with the high level of VOCs at that location. Polycyclic aromatic hydrocarbons (PAHs) were highest in TP-2.

Bis(2-ethylhexyl) phthalate is the most widespread semivolatile contaminant detected at the Site, with significant concentrations in all the test pit locations. The detected concentrations range up to 1,300 mg/kg. The highest concentrations of this compound were found in the south-central portion of the landfill; the maximum concentration was detected in TP-6. Concentrations above 1,000 ug/kg were detected at all test pit locations. Other phthalates (Dibutyl phthalate, Dioctyl phthalate, Diethyl phthalate, and butyl benzyl phthalate) were also detected throughout the landfill. PAHs and phthalates tend to adsorb onto soil and migrate slowly. Because of these factors and their low solubility in water, leaching to groundwater is usually less of a concern than with VOCs.

PCBs were detected in all test pits except TP-7. The highest levels of PCBs were 4.6 mg/kg (Aroclor 1248) in TP-6 and 140 mg/kg (Aroclor 1254) in TP-1. Several chlorinated pesticides were detected throughout the landfill with no clear pattern of distribution. PCBs and pesticides tend to adsorb onto soil and migrate slowly in this medium. They tend to bioconcentrate significantly in environmental receptors.

Several inorganics were detected in several locations in all the test pits. The highest concentrations were detected predominantly in TP-5 and TP-6. The highest concentrations of selected inorganic substances are presented below.

Aluminum	14,400 mg/kg
Arsenic	8 mg/kg
Beryllium	11.9 mg/kg
Cadmium	15.3 mg/kg

Chromium	538 mg/kg
Manganese	1,800 mg/kg
Mercury	3.1 mg/kg
Nickel	533 mg/kg
Vanadium	76.6 mg/kg

Surface Water, Sediment, and Spring Samples

From each sample location designated in Figure 3, a surface water and a sediment sample was collected. With the exception of sample locations 8, 9, and 10 (located on springs immediately north of the landfill) all surface water and sediment samples collected from the Berkley Products Site were tested for the full-scan organic and inorganic analysis. At locations 8, 9, and 10, the solid (sediment) samples were collected for a full scan of inorganic and organic analysis, but there were only sufficient sample volumes for volatile organics analysis of the water. The sample locations 6, 5 and 4 were determined to be upstream of the Site, while the sample locations 3, 2, 7 and 1 are the downstream locations.

A comparison of maximum downstream surface water data to upstream data is included in Table 4. Cadmium (1.2 ug/l), silver (2 ug/l), lead (3.6 ug/l), 2-Butanone (0.7 ug/l) and 1,1,1-TCA (0.7 ug/l) were detected in downstream samples and not the upstream samples. Barium (82.3 ug/l) and manganese (139 ug/l) were also detected in downstream samples at levels slightly above upgradient concentrations. All levels detected in downgradient aqueous samples were below risk-based concentrations. Risk-based concentrations are concentrations corresponding to acceptable risks according to the NCP and are used to screen out chemicals that would not contribute significantly to risk. Because the VOC chemicals tend to evaporate rapidly from surface media, these limited findings are not unexpected.

A comparison of maximum downstream sediment data to upstream sediment data is included in Table 5. Although 2-Butanone, indeno(1,2,3-c,d)pyrene, 4-methylphenol, Butylbenzyl phthalate, phenol, aluminum, arsenic, barium, beryllium, chromium, cobalt, copper, manganese, nickel, vanadium, and zinc are at slightly higher levels in the downstream sample, it was determined that downstream sediment concentrations were not significantly higher than the upstream conditions. Additionally, the downstream levels are below the human health risk-based concentrations.

The maximum surface water sample data from the four springs located north of the landfill are presented in Table 6. VOC analysis from the four samples revealed 2-Butanone and carbon disulfide. All levels were below risk-based concentrations.

A comparison of the maximum sediment data from the four springs to the background soil data and upstream sediment data is included in Table 7. Aluminum (11,400 mg/kg), arsenic (4.4 mg/kg), beryllium (1.2 mg/kg), and manganese (1,220 mg/kg) have been detected above background levels and at levels of concern. Organic compounds detected at levels above background and upstream sediment samples are 2-hexanone, 2-butanone, toluene, phenol, 4-methylphenol, 2-methylphenol, and acetone. The concentrations of organic compounds are all below risk-based concentrations. These springs lie north of the landfill and between the landfill and Cocalico Creek.

The sediment analytical data from the east leachate seep are included in Table 8. The inorganic compounds arsenic (1.6 mg/kg), beryllium (0.59 mg/kg), and chromium (48.5 mg/kg) were detected above background concentrations and at levels of concern. Also detected were 2-butanone, bis(2-ethylhexyl) phthalate, chloromethane, and di-n-octyl phthalate, but at levels below risk-based concentrations.

TABLE 4
STREAM SURFACE WATER DATA EVALUATION (ug/L)
BERKLEY PRODUCTS, PENNSYLVANIA

CHEMICAL	MAXIMUM DOWNSTREAM	RANGE UPSTREAM
INORGANICS		
barium	82.3	64.3 to 68.7
cadmium	1.2	
calcium	20,300	19,800 to 24,300
copper	19.4	19.7
iron	1,310	425 to 490
lead	3.6	
magnesium	4,180	3,170 to 3,990
manganese	139	65.5 to 86.9
mercury		0.21
potassium	1,720	1,190 to 1,700
silver	2	
sodium	7,180	5,600 to 6,270
cyanide	11	ND to 11.9
ORGANICS		
2-butanone	0.7	
1,1,1-TCA	0.7	
phenol		23
1,2-dichloroethene	2	

ND = Not Detected
No COPC (Chemical of potential concern)

TABLE 5
STREAM SEDIMENT DATA EVALUATION (mg/kg)
BERKLEY PRODUCTS, PENNSYLVANIA

CHEMICAL	MAXIMUM DOWNSTREAM	RANGE UPSTREAM
INORGANICS		
Aluminum	13,600	1,380 to 5,130
Antimony		3.7
Arsenic	1.9	1.3
Barium	196	27.7 to 93.4
Beryllium	0.77	0.43-0.56
Calcium	1,810	323 to 5,520
Chromium	15.7	2.6 to 8.5
Cobalt	9.2	1.2 to 4.2
Copper	5.9	
Iron	13,800	2,240 to 6,030
Lead	17.8	3.5 to 13
Magnesium	2,280	282 to 1,650
Manganese	335	150 to 262
Nickel	14.6	3.5 to 4.5
Potassium	1,040	134 to 311
Sodium	94.3	68.5
Vanadium	28.3	4 to 13.6
Zinc	52.4	11 to 27.4
ORGANICS		
2-butanone	.019	.016
Toluene		.002 to .048
Bis(2-ethylhexyl) phthalate	.076	.038 to 0.1
Benz(a)anthracene	.062	.09
Benzo(a)pyrene	.05	.068
Benzo(b)fluoranthene	.079	0.1
Benzo(k)fluoranthene		.04

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TABLE 5
STREAM SEDIMENT DATA EVALUATION (mg/kg)
BERKLEY PRODUCTS, PENNSYLVANIA
PAGE 2 of 2

CHEMICAL	MAXIMUM DOWNSTREAM	RANGE UPSTREAM
Chrysene	.074	.097
Fluoranthene	.055	.180
Indeno(1,2,3-c,d)pyrene	.052	.050
Phenanthrene	.041	.14
Pyrene	.082	.12
4-Methylphenol	.44	
Butylbenzyl phthalate	.12	
Phenol	.11	

No COPC (Chemical of potential concern)

TABLE 6
SPRING SURFACE WATER DATA EVALUATION (ug/L)
BERKLEY PRODUCTS, PENNSYLVANIA

CHEMICAL	SW8	SW9	SW10	SW11
INORGANICS				
Aluminum	N/A	N/A	N/A	4,680
Antimony	N/A	N/A	N/A	
Arsenic	N/A	N/A	N/A	
Barium	N/A	N/A	N/A	134
Beryllium	N/A	N/A	N/A	1.6
Cadmium	N/A	N/A	N/A	
Calcium	N/A	N/A	N/A	9,390
Chromium	N/A	N/A	N/A	15.5
Cobalt	N/A	N/A	N/A	
Copper	N/A	N/A	N/A	19.1
Iron	N/A	N/A	N/A	6,500
Lead	N/A	N/A	N/A	
Magnesium	N/A	N/A	N/A	3,460
Manganese	N/A	N/A	N/A	109
Mercury	N/A	N/A	N/A	
Nickel	N/A	N/A	N/A	
Potassium	N/A	N/A	N/A	1,090
Selenium	N/A	N/A	N/A	
Silver	N/A	N/A	N/A	
Sodium	N/A	N/A	N/A	4,860
Thallium	N/A	N/A	N/A	
Vanadium	N/A	N/A	N/A	
Zinc	N/A	N/A	N/A	37.5
Cyanide	N/A	N/A	N/A	
ORGANICS				
2-Butanone			1	
Carbon disulfide		17		

N/A = Not analyzed
No COPC (Chemical of potential concern)

TABLE 7
SPRING SEDIMENT DATA EVALUATION
BERKLEY PRODUCTS, PENNSYLVANIA
(MG/KG)

CHEMICAL	MAXIMUM SPRING SEDIMENT	MAXIMUM BACKGROUND SOIL	MAXIMUM UPSTREAM SEDIMENT
INORGANICS			
Aluminum[1]	11,400	4,080	5,130
Arsenic[2]	4.4	0.7	1.3
Barium	149	38.5	93.4
Beryllium[2]	1.2		0.56
Cadmium		0.06	
Calcium	2,370	NR	5,520
Chromium	25.3	4.8	8.5
Cobalt	11.7	3.3	4.2
Copper	26.9	7	
Iron	22,700	4,300	6,030
Lead	41.1	18.3	13
Magnesium	1,610	NR	1,650
Manganese[3]	1,220	150	262
Nickel	16.2	4.6	4.5
Potassium	766	NR	311
Sodium	80	NR	68.5
Vanadium	38.9		13.6
Zinc	118	19	27.4
Cyanide			
ORGANICS			
2-Hexanone	.004		
2-Butanone	.03		.016
Toluene	.21		.048
Bis(2-ethylhexyl) phthalate	.096	.528	.1

TABLE 7
SPRING SEDIMENT DATA EVALUATION
BERKLEY PRODUCTS, PENNSYLVANIA (MG/KG)
PAGE 2 of 2

CHEMICAL	MAXIMUM SPRING SEDIMENT	MAXIMUM BACKGROUND SOIL	MAXIMUM UPSTREAM SEDIMENT
ORGANICS (continued)			
Benzoic acid		1.600	
Phenol	.140		
Benzo(b)fluoranthene			.1
Benzo(k)fluoranthene			.04
Chrysene			.097
Fluoranthene			.18
Indeno(1,2,3-c,d)pyrene			.05
Phenanthrene			.14
Pyrene			.12
Di-n-butyl phthalate		3.034	
4-Methylphenol	.83		
2-Methylphenol	.83		
Acetone	.14		

NR = Result not reported by laboratory
(1) COPC SD-9
(2) COPC for all sediment sample locations
(3) COPC for SD-8 and SD-10
COPC (Chemical of potential concern)

TABLE 8
LEACHATE SEDIMENT DATA EVALUATION (mg/kg)
BERKLEY PRODUCTS, PENNSYLVANIA

CHEMICAL	LD-1	MAXIMUM BACKGROUND
INORGANICS		
Aluminum	7,120	4,080
Arsenic[1]	1.6	0.7
Barium	209	36.5
Beryllium[1]	0.59	
Cadmium		0.06
Calcium	4,240	NR
Chromium[1]	48.5	4.8
Cobalt	8.4	3.3
Copper	8	7
Iron	64,000	4,300
Lead	17.8	18.3
Magnesium	2,180	NR
Manganese	393	150
Nickel	16.4	4.6
Potassium	1,200	NR
Sodium	247	NR
Vanadium	18.4	
Zinc	112	19
ORGANICS		
2-Butanone	.016	
Bis(2-ethylhexyl) phthalate	3.3	.526
Chloromethane	.001	
Di-n-octyl phthalate	.19	

NR = Results not reported by laboratory
[1] Chemical of potential concern (COPC)

Groundwater Data

The groundwater analytical data are included in Tables 9, 10, and 11. The maximum groundwater analytical data from on-site monitoring wells MW-2, MW-3, and MW-4 are compared to the background wells at the MW-1 cluster from the two rounds of monitoring well sampling in Table 9. The data show the extensive range of organic and inorganic compounds detected in the wells directly adjacent to the landfill. MW-4s and MW-4l were sampled from the bottom of the well before they were purged to test for the presence of DNAPL. This analytical data set from the samples collected prior to purging is also presented in Table 10. A suspected DNAPL sample was collected from the two wells.

The maximum groundwater analytical data set from the three rounds of home well sampling (1990, 1991, 1993) is included in Table 11. Results from the background monitoring wells (filtered) MW-1/91 and MW-1/93 are also shown. Analytical results indicate that groundwater in residential water supplies appears to be virtually free of any organic contaminants. Inorganics and metals were identified in all well samples, including those hydrologically upgradient of the Site. However these results were found to be inconsistent between rounds. In cases where notable levels were observed, follow-up sampling often failed to confirm earlier results. EPA believes that some of the metals may be attributed to natural sources (minerals), and others may be associated with the home well systems (piping, solder, pumps, etc.).

Considering the lack of organic compounds, the hydrogeology of the area, and the low level and sporadic concentrations (i.e. observed during one sample round but not observed during another) of metals recorded in the residential wells, EPA has determined that the residential wells are not being impacted by the Site.

Contaminant Fate and Transport

At the Berkley Products Site, the past disposal practices have resulted in the release of contaminants to the fill materials and soils throughout the landfill. These contaminants may be migrating from the landfill into environmental media and pose potential threats. Using information developed during the RI, an assessment of contaminant fate and transport was performed to identify how potential contaminant migration could pose threats to human health and the environment. Because the analytical and hydrogeologic information developed during the RI was limited, it is not possible to prepare quantitative estimates of contaminant migration.

Based on landfill measurements, EPA has calculated that approximately 103,300 cubic yards of materials are present in the landfill; these materials are contaminated by a variety of organic and inorganic constituents. Contaminated soil and fill materials are continuing sources of VOCs, SVOCs, PCBs, and metals to other environmental media.

Factors that influence the migration of major contaminant groups (VOCs, SVOCs, PCBs, and metals) include the contaminants' chemical and physical properties (e.g., solubilities, adsorption coefficients, vapor pressure, partitioning coefficients, etc.); site features (e.g., topography, geology) that affect precipitation infiltration and runoff; and the contaminants' concentrations. Additional factors such as groundwater pH and the presence of other contaminants that may alter contaminant solubilities can also significantly influence contaminant transport.

TABLE 9
MONITORING WELL DATA EVALUATION (ug/L)
BERKLEY PRODUCTS, PENNSYLVANIA

CHEMICAL	MAXIMUM CONCENTRATION FROM ON-SITE WELLS MW-2, MW-3, AND MW-4	MAXIMUM BACKGROUND
INORGANIC FILTERED SAMPLE RESULTS		
Aluminum	1,030	386
Arsenic(1)	7.9	
Barium(1)	14,700	230
Calcium	1,090,000	27,800
Chromium(1)	27.8	4.2
Cobalt	61.9	16.1
Copper	27	
Iron	76,800	5,650
Lead(1)	7.6	7.4
Magnesium	172,000	6,450
Manganese(1)	69,800	1,010
Mercury	0.92	2.5
Nickel(1)	1340	58.4
Potassium	55,900	5,640
Sodium	284,000	8,560
Vanadium	23.4	
Zinc	587	38.5
ORGANICS		
Methylene chloride(1)	860	
Acetone	170	
Chloroform(1)	4	
2-butanone(1)	280	
TCE(1)	72	
PCE(1)	16	
Toluene(1)	4800	1

TABLE 9
MONITORING WELL DATA EVALUATION (ug/L)
BERKLEY PRODUCTS, PENNSYLVANIA
PAGE 2 OF 2

CHEMICAL	MAXIMUM CONCENTRATION FROM ON-SITE WELLS MW-2, MW-3, AND MW-4	MAXIMUM BACKGROUND
Chlorobenzene	3	
Ethylbenzene[1]	170	
1,2-Dichloroethane[1]	2	
1,1,2-TCA[1]	15	
4-Methyl-2-pentanone[1]	810	
Xylenes[1]	1,200	
Diethyl phthalate	8	
Bis(2-ethylhexyl) phthalate[1]	18	3
1,4-Dichlorobenzene[1]	14	
Benzyl alcohol	3	
2-Methylphenol	26	
4-Methylphenol	8	
Isophorone	3	
4-Chloro-3-methylphenol	9	
Beta-hexachlorocyclohexane[1]	0.045	
Dieldrin	0.1	
Endosulfan II	0.69	
Vinyl chloride[1]	22	
Carbon disulfide[1]	3	
1,1-Dichloroethane	5	
1,2-Dichloroethene[1]	40	
1,2-Dichlorobenzene	2	
Naphthalene	2	
Phenol	2	
Gamma-hexachlorocyclohexane[1]	0.2	
Heptachlor epoxide[1]	0.098	

[1] Chemical of potential concern (COPC)

TABLE 10
MONITORING WELL DNAPL DATA COMPARISON (ug/L)
BERKLEY PRODUCTS, PENNSYLVANIA

DNAPL COMPARISONS	ON-SITE WELL MAXIMUM CONCENTRATION	MW4SDN DNAPL	MW4IDN DNAPL
Methylene chloride[1]	860		700
Acetone	170		
Chloroform[1]	4		
2-Butanone	280		140
TCE[1]	72		1
Benzene[1]	89		36
PCE[1]	16		3
Toluene[1]	4,800	1,900	95
Chlorobenzene	3		3
Ethylbenzene[1]	170	200	3
1,2-Dichloroethane[1]	2		5
1,1,2-TCA[1]	15		3
4-Methyl-2-pentanone[1]	810		260
Xylenes[1]	1,200	1,400	310
Diethyl phthalate	8	6	3
Bis(2-ethylhexyl) phthalate[1]	18		
1,4-dichlorobenzene[1]	14	6	5
Benzyl alcohol	3		
2-Methylphenol	26	24	
4-Methylphenol	8	21	
Isophorone	3		3
4-Chloro-3-methylphenol	9		
Beta-hexachlorocyclohexane[1]	0.045		
Dieldrin	0.1		
Endosulfan II	0.69		
Vinyl chloride[1]	22		3
Carbon disulfide[1]	3		

TABLE 10
MONITORING WELL DNAPL DATA COMPARISON (ug/L)
BERKLEY PRODUCTS, PENNSYLVANIA
PAGE 2 OF 2

DNAPL COMPARISONS	ON-SITE WELL MAXIMUM CONCENTRATION	MW4SDN DNAPL	MW4IDN DNAPL
1,1-Dichloroethane	5		4
1,2-Dichloroethene[1]	40		2
1,2-Dichlorobenzene	2		
Naphthalene	2	3	3
Phenol	2		
Gamma-hexachlorocyclohexane[1]	0.2	0.21	0.22
Heptachlor epoxide[1]	0.098		0.067
Gamma-chlordane		0.1	
Aroclor 1254		11	
4-Chloro-3-methylphenol		13	4
4,4'-DDE		0.4	

[1] Chemical of potential concern (COPC)

TABLE 11
HOME WELL DATA EVALUATION MAXIMUM CONCENTRATIONS (ug/L)
BERKLEY PRODUCTS, PENNSYLVANIA

CHEMICAL	SAMPLE LOCATIONS									
	HW-1	HW-2	HW-3	HW-4	HW-5	HW-6	HW-7	HW-8	HW-9	HW-9N
INORGANICS										
Aluminum										
Antimony			5.9							
Arsenic	2.1									
Barium	78.7	3.4	185	82.3	160	471	316	153	106	93.6
Beryllium							1.5			
Cadmium									158	
Chromium										
Cobalt										
Copper	71.4	14.3	114	80.2	8.7	539	121		368	106
Iron	180	50.5	98.7	199	15.9	777	4910	185	32.4	42.7
Lead	104		15.2	24.9		39.7	22.5		6.8	5.2
Manganese			3.4	6	3.1	12.7	39.3		5.4	
Mercury	0.67	0.54					1.7			2
Nickel		34					7.6			
Selenium							2.3			
Silver		9.6								
Thallium										
Vanadium		9.4								
Zinc	11.3	17.6	4.5			96.6	28.4		4290	570
Cyanide										
ORGANICS										
Butylbenzyl phthalate			4							
Acetone										

TABLE 11
HOMEWELL DATA EVALUATION MAXIMUM CONCENTRATIONS (ug/L)
BERKLEY PRODUCTS, PENNSYLVANIA
PAGE 2 of 3

CHEMICAL	SAMPLE LOCATIONS									
	HW-10	HW-11	HW-12	HW-13	HW-14	HW-15	HW-16	HW-17	MAX F	MAX F
INORGANICS										
Aluminum		1040	20.8		19.5					386
Antimony										
Arsenic		12.8			2.4					
Barium	231	145	133	174	300	251		184	217	230
Beryllium		1.2								
Cadmium										
Chromium	5.2	16	4.2		4.4	3.3			4.2	
Cobalt									4.2	16.1
Copper	276	724		213			17.1	19.1		
Iron	50.1	37000	117		263		37.6	1640	2750	5650
Lead	2.9	74.4						2.4		7.4
Manganese		454						49.2	260	1010
Mercury					1.5					2.5
Nickel		14.2	24.4	26.3						58.4
Selenium										
Silver										

TABLE 11
HOME WELL DATA EVALUATION MAXIMUM CONCENTRATIONS (ug/L)
BERKLEY PRODUCTS, PENNSYLVANIA
PAGE 3 OF 3

CHEMICAL	SAMPLE LOCATIONS									
	HW-10	HW-11	HW-12	HW-13	HW-14	HW-15	HW-16	HW-17	MAX F	MAX F
Thallium										
Vanadium	3	42				4.6				
Zinc	297	39.5			11.7		6.4	7.8		38.5
Cyanide										
ORGANICS										
Butylbenzyl phthalate										
Acetone			23							

The geologic and hydrogeologic properties of the Site also influence migration of contaminants. The aquifer beneath the facility consists of interbedded sedimentary rock units. The bedding planes appear to have rotated over time into an east-west orientation and have an approximately 35-degree dip to the north. Bedding plane fractures and joint cracks are present and may be preferential pathways for groundwater flow. The overall groundwater flow at the landfill appears to be to the east and the northeast and is probably discharging to Cocalico Creek from the shallow and deep portions of the bedrock aquifer. The RI report concludes that the major groundwater flow direction from the Berkley Products Site is to the east, with the predominant flow immediately beneath the fill area being a downward vertical flow. The eastward-flowing groundwater at shallow and intermediate depths is predicted to discharge into Cocalico Creek. The deeper bedrock groundwater may also discharge to the creek. The creek may be influenced by the presence of a fault plain east-northeast of the Site.

Based on the groundwater flow direction and the chemical concentrations observed in monitoring wells (MW-4S and MW-5S) at the eastern portion of the study area, contaminants are likely to be migrating outside the boundaries of the landfilled area, into the deep bedrock portion of the aquifer.

A qualitative review of the Site features, geologic and hydrogeologic properties, and contaminants identified to date indicates the following potential contaminant fate and migration conditions:

- The fill materials are poorly covered and are exposed to the ambient air. Numerous organics present in the fill and soil materials can volatilize to the ambient air and migrate beyond the Site boundaries. Soil gas results have indicated the presence of volatile organic compounds at shallow depths (0 to 3 feet).

- The contaminated fill materials and soils are available to migration off site through erosion by the action of precipitation runoff or by wind.

- Precipitation that infiltrates into the subsurface materials is leaching contaminants into the underlying bedrock groundwater aquifer. Groundwater underlying the fill appears to be contaminated by numerous contaminants and is likely migrating away from the landfill eastward toward Cocalico Creek. The groundwater immediately beneath the fill is flowing predominantly vertically downward and to the east. The shallow and intermediate portions are thought to discharge to Cocalico Creek. The deeper portions may also discharge or flow in an upward direction in the creek area.

- Seasonal seeps and springs have been identified in the vicinity of the landfill. The RI indicated that those surface features north of the Site occur as the result of shallow seasonal groundwater discharge. The seeps south of the Site occur immediately at the base of the fill and appear to be closely related to rain events. Contaminated groundwater and seeps that emerge at the ground surface can travel as runoff and subsequently enter Cocalico Creek.

- Available data do not indicate that the Berkley Products Site is contributing to the degradation of residential wells in the area; however, the hydrology of the area has not been fully defined. While no significant Site-related contamination has been observed to date in private wells, it is unclear what the impact of Site contaminants on those wells may be in the future.

- Because solvent components have been detected in the fill materials of the landfill, and based on past disposal practices, it is possible that non-aqueous phase liquids (NAPLs) are present in the landfill. These NAPLs, if present and not addressed, would serve as continuing contaminant sources to groundwater and soil gases that would likely migrate off-site.

- The qualitative assessment of Site contaminant fate and migration indicates that organic and inorganic constituents can migrate off-site and affect other environmental media and subsequently pose exposure risks to humans and biological receptors.

- The results of the Remedial Investigation indicate that the soils and landfill materials on the plateau reside above the water table. Therefore, precipitation infiltration would be the <u>principal</u> driving force for leaching of contaminants into groundwater.

VI. SUMMARY OF SITE RISKS

The primary Site-related risks posed by the Berkley Products Superfund Site are derived from potential contact with, and migration of the contaminants contained in the landfill materials and soils. Contaminants of concern in the Site soils were determined from numerous soil samples collected from test pits in February and March of 1991. Given the extremely high levels of the contaminants discovered in the test pits, as well as the mobile natures, of several of the compounds, it is probable that the test pit soils continue to serve as a source of contamination to the groundwater underlying the Site.

<u>Human Health Risk Assessment</u>

Baseline risk assessments are conducted for Superfund investigations to determine the health risk presented by the Site conditions. Cancer and Non-cancer risks are calculated using anticipated exposure assumptions, such as duration of exposure and combination of the various exposure pathways, e.g. inhalation of dust, direct skin contact with contaminated materials, and drinking of contaminated water. All of these variables are combined to generate an estimated risk level. The detailed assumptions may be found in the baseline risk assessment, Section 5 of the Remedial Investigation Report. The cancer and non-cancer risk levels are expressed in the formats of the following examples:

> **Cancer Risk Format** - Reported in the format: 1 E-04, or 1×10^{-4} - both of which signify one additional chance in 10,000 for a susceptible individual to contract cancer above the normal cancer incidence in the general population. In general, EPA considers any calculated environmental risk greater than 1 E-04 to be unacceptable.
>
> **Non-Cancer Risk Format** - Chronic Hazard Index (HI) = 1; EPA believes that a Chronic HI that exceeds 1 presents an unacceptable risk to human health.

The Baseline Risk Assessment presented in Section 5 of the RI report identified contaminants in the environmental media that pose cancer and non-cancer risks to human health through several potential pathways.

Direct Contact Risk

Two potential scenarios were considered in assessing human exposure to surficial soils and landfill materials: residential and recreational user. The hypothesized exposure pathways include incidental ingestion and dermal contact and inhalation of fugitive dusts.

Under the residential scenario, the estimated excess lifetime cancer risk was 1 E-04, meaning that there is the potential that one additional person for every 10,000 residential users would contract cancer due to exposure to the landfill materials and contaminated soil and dust. Beryllium was the major cancer risk contributor. The Hazard Index (HI) calculated for this scenario was less than 1 (approximately 0.8 for children and 0.2 for adults) for non-cancer risks.

Under the recreational user scenario, the cancer risk was 2 E-05 and the HI was less than 1 (approximately 0.1 for children and 0.02 for adults) for non-cancer risks. Arsenic and beryllium were the primary contributors of cancer risk.

Inhalation of fugitive dusts was estimated to generate a 1 E-07 cancer risk and an HI of less than 1 for children (0.04) and adults (0.01).

Subsurface soil data did not lend themselves to a quantitative risk evaluation. Because of the heterogeneous nature of the landfill material and the varying depth of sampling locations, a semi-quantitative analysis was performed. The analytical data indicated that the extent of contamination and concentrations were generally greater than identified in the surface samples. A semi-quantitative evaluation of the data, assuming a combined child and adult exposure scenario and assuming that the landfill material was available for direct contact, resulted in cancer and non-cancer risks exceeding EPA acceptable risk ranges. The calculated HQs for some of the compounds exceeded 1. Sample results of the polychlorinated biphenyl compound Aroclor 1254 alone generated a HQ of 140 and an excess cancer risk of 3 E-03.

The evaluation assumed that the subsurface material became available for contact through erosion and/or excavation. Although it cannot be assumed that the increase in risk from the future deterioration of the landfill will be identical to the risks calculated from the subsurface soil samples, it is apparent that if left unaddressed the risks from the landfill will increase as more subsurface materials become exposed.

Potential Risks from Ingestion of Contaminated Water

Monitoring Wells

Groundwater collected from monitoring well clusters situated at the landfill's perimeter was found to contain volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals. Under a hypothetical scenario where groundwater from the MW-2, MW-3, and MW-4 well clusters is used for residential water supplies, the estimated cancer risk was 1 E-03, and the HI is greater than 1 (approximately 926 for children and 397 for adults) for non-cancer risks.

The major contributors of cancer risk include arsenic, beryllium, methylene chloride, and vinyl chloride. Arsenic, barium, manganese, toluene, nickel, and benzene were significant contributors of non-cancer risks.

MW-5 was considered separately because the types and concentrations of chemicals detected were fewer than for the other three monitoring well clusters. The total cancer risk for potential use of the groundwater from this well would be 2 E-04, and the HI would exceed 1 (53 for children and 23 for adults). Beryllium is the primary contributor of cancer risk, and barium, manganese, and nickel posed excess non-cancer HIs greater than 1.

Residential Wells

Residences in the vicinity of the landfill use groundwater drawn from the underlying bedrock aquifer. One shallow hand-dug well in close proximity to and immediately downgradient from surface drainage patterns from the Berkley Products Site was removed from service prior to the RI after it exhibited contamination. This well was replaced with a drilled well that has not shown contamination related to the Berkley Products Site.

Three rounds of residential well samples were collected during 1990, 1991, and 1993. Analytical results indicate that groundwater in residential water supplies appears to be virtually free of any organic contaminants. Metals were identified in all well samples, including those hydrologically upgradient of the Site. The risk assessment asserts that some of the metals may be attributed to natural sources (minerals), and others may be associated with the well systems (piping, solder, pumps, etc.).

The risk assessment determined that cancer risks from ingestion of residential well water were typically within the acceptable risk range. In a few cases, the total non-cancer risks slightly exceeded the HI of 1.0; however, in all but two cases the Hazard Quotients for the individual constituents separately did not exceed 1.0. Lead was found to have exceeded the 15 μg/L Action Level in a few homes; these residents have already been notified regarding the presence of lead in their water supplies. The two wells with HIs greater than 1 (HW-9 and HW-11) are reported to be hydrogeologically upgradient of the Site. HW-9 has been replaced by a newer well.

Considering the lack of organic compounds, and the low level and sporadic concentrations (i.e. observed during one sample round but not observed during another) of metals recorded in the residential wells, EPA has determined that the residential wells are not being impacted by the Site.

Surface Water

One spring and several seeps have been identified at locations surrounding the landfill. The risk assessment expected no significant contributions to human health risk from exposure to contaminants present in the spring and nearby stream since the concentrations were low.

Potential Risks from Exposure to Contaminated Sediments

The Cocalico Creek stream sediment sample concentrations were sufficiently low that the screening risk assessment concluded no significant impact to human health from exposure to stream sediments.

The exposure to contaminants in spring and leachate sediments poses some risk but is generally within the acceptable risk range.

Spring sediment samples were obtained from four locations. The estimated cancer risk for the spring sediments ranged from the higher end of the acceptable risk range for residential users, 1 E-4, to well within the acceptable range (E-05) for recreational users. Cancer risks are primarily attributable to beryllium, with the presence of arsenic contributing to the overall total risk.

Cancer risks for exposure to leachate sediments were 7 E-05 and 1 E-05 for the residential and recreational user scenarios, respectively. Arsenic and beryllium were identified as the principal risk contributors. Non-cancer risks were estimated to be less than 1.0.

Additive risk

It is possible that a single receptor could be exposed to more than one contaminated medium, therefore increasing his or her total risk. At this site, for the pathways evaluated, it would be theoretically possible for a receptor to be exposed to a drinking water source and a soil source. For residential on-site soil exposure, the drinking water source would be assumed to be water typical of the monitoring well concentrations. Those risks exceeded 1E-4 (cancer) and 1 (noncarcinogenic HI). For residents at the houses with existing sampled home wells, the major soil exposure would be to the soil in their own yards. Therefore, the most appropriate scenario for additivity was assumed to be existing residential wells as the water source, with recreational (occasional) contact with soil or sediment.

In this discussion home wells without COPCs were not included. For home well nos. 9 and 11 which are both upgradient of the Site, HIs already exceeded 1 for each of these water sources in and of themselves. Therefore, for risk assessment purposes, it was unnecessary to add other pathways to these sources, since exposure to contaminants in other media would only serve to further increase a risk that has already been identified as potentially substantial.

Therefore, the potential drinking water sources were home well nos. 1, 3, 6, 7, 9N, 10, 13, 14, and 17; the potential soil/sediment sources for recreational contact were surface soil, leachate sediment, and spring sediment SD-8, SD-9, SD-10, and SD-11. For all combinations of chemicals with similar target organs, the total HIs are less than 1. The cancer risks were between 1E-4 and 1E-6, except for combinations including HW-7, whose estimated cancer risk was at approximately 1E-4 for the water alone.

Ecological Risk Assessment

A Tier 1 Ecological Risk Assessment (ERA) was prepared as part of the RI, in accordance with EPA Region III's Interim Ecological Risk Assessment Guidelines (July 27, 1994). Summaries of the ERA conclusions are presented in this section.

The ERA is based upon development of the most conservative Environmental Effects Quotients (EEQs). The EEQ is defined as the reported environmental concentration divided by the chronic toxicity value derived from literature, AWQC or other sources. Individual EEQs exceeding 1.0 indicate risk potential. Additive EEQ values can be calculated and serve as a check. When the additive value for a medium (e.g., soil) is over 100, it can be safely concluded that a potential for risk exists. When the additive value is below 10, the case for potential risk is not as clear. It is that area between 10 and 100 that is the gray area of potential risk. For those habitats, it is best to assume that risk potential exists and that some action should be taken, even if it is only monitoring. However, with some contaminants, e.g., organic compounds that bioaccumulate, such as chlorinated hydrocarbons, and inorganic compounds that are transformed into organic forms, such as lead and mercury, the lower additive value should still be viewed as representative of a potential for risk.

A number of organic chemicals and metals have been detected in surface soils, seep sediments, leachate, and groundwater at the Site. Flora and fauna can become exposed to these contaminants through a variety of pathways. Species that reside or forage at the Site or species that prey on resident species can be exposed through direct contact or incidental ingestion. Plants can become affected through uptake of contaminants by their root systems. In turn, the plants may be consumed by insects and animals and the contaminants bioaccumulated through the food chain.

Surface Soils

The ERA concluded that Site soils constituted the primary source of contamination and were the medium to which ecological receptors would have the most exposure. Contamination in Site soils posed potential threat to vegetation, through uptake, and to resident insects and foraging and burrowing animals. Migratory fauna and avians may use the Site for habitats or opportunity resting and feeding purposes and thus become exposed to Site contaminants.

Table 12 shows those surface soils contaminants with EEQs greater than one (1) as well as the additive EEQ for surface soil. Both individual and additive values determined for the surface soils indicate environmental risk.

Seeps

Groundwater discharges to the surface occur intermittently at the seep locations. The ERA concludes that seep leachates may attract insects and insect predators and promote plants' growth, which in turn promotes the presence of foraging and root-eating animals. Flora and fauna would be exposed to groundwater contaminants that emerge at the seep locations.

Leachate Sediments

The ERA concluded that, while seeps were intermittent, contaminants may accumulate and remain adsorbed to the soils and sediments where leachate breaks out at the surface. The sediments are therefore probably long-term contaminant sources. As in the case of contaminated soils, flora can grow in these areas and residing and foraging fauna become affected by contaminants.

VII. DESCRIPTION OF ALTERNATIVES

Remedial Action Objectives

As discussed in Section VI, Summary of Site Risks, the human health risks posed by the individual media at the Site are currently within EPA's acceptable target risk range for the currently available exposure pathways that were evaluated. Exposure to surface soil however was at the limit bordering unacceptable risks. Evaluation of contamination in the monitoring wells and subsurface soils indicates that deterioration of the landfill and potential use of groundwater in the immediate vicinity of the landfill would present higher human health risks, outside the acceptable risk range, as well as increasing the availability of contamination for uptake into plants and bioaccumulation in the ecological food chain.

The Remedial Action Objectives (RAOs) of the Feasibility Study conducted for this Site are to prevent unacceptable human exposure and minimize the exposure of ecological receptors to contaminated soils and landfill materials, minimize potential exposure to contaminants in landfill leachate, gas, and Site groundwater, and minimize contaminant migration from the landfill into the environment.

The Superfund Law requires that alternatives to address the contamination at hazardous waste sites be assessed. The alternatives are to be designed to be protective of human health and the environment. The alternative selected for implementation must be protective as well as cost-effective

TABLE 12
SURFACE SOIL ENVIRONMENTAL EFFECTS QUOTIENTS
INDIVIDUAL AND ADDITIVE VALUES

Contaminant	EEQ
Barium	1.375
Chromium	7.45
Cobalt	1.067
Copper	3.53
Lead	3.86
Mercury	5.3
Nickel	1.655
Silver	1.1
Zinc	4.1
Cyanide	2.14
Toluene	11.0
Phenol	18.0
Acenaphthene	1.1
Benz(a)Anthracene	4.4
Benzo(B)Fluoroanthene	4.8
Benzo(A)Pyrene	5.8
Benzo(G,H,I)Perylene	3.9
Benzo(K)Fluoranthene	3.4
Chrysene	5.0
Dibenz(A)Anthracene	1.8
Fluroanthene	3.4
Indeno 1,2,3-c,d pyrene	2.9
Pyrene	6.9
PCB	2.7
ADDITIVE VALUE	**106.677**

and in accordance with statutory requirements. Permanent solutions to contamination are to be achieved whenever possible. In addition, emphasis is placed on treating wastes on-site wherever possible; to reduce the toxicity, mobility, or volume of Site-related contaminants, and on applying alternative or innovative technologies

Because the Berkley Products Site is similar to numerous other municipal landfills contaminated by hazardous substances, the presumptive remedy approach can be applied in the development of remedial alternatives. Presumptive remedies, as presented in EPA OSWER Directive No. 9355.0-49FS, are preferred technologies developed to address sites with similar characteristics such as contaminant presence, types of disposal practices, and impacts to environmental media. The use of presumptive remedies is meant to promote focused data collection, resulting in streamlined site assessments and accelerated remedy selection that achieve time and cost savings.

The Berkley Products Site was operated as a municipal landfill for a number of years and subsequently contaminated by industrial chemicals and by-products. The use of the presumptive remedy is appropriate for this Site because of the Site's historical use and disposal history and because Site conditions are consistent with the generic conceptual site model for a municipal landfill. Based on EPA's evaluation of all NPL sites, municipal landfills contaminated by hazardous substances account for approximately 230 sites; as a group, landfills comprise a large fraction of NPL sites. Because of the large volumes of municipal debris mixed with hazardous substances, treatment is considered to be technically impracticable for municipal landfills. The presumptive remedy for these sites, based on EPA's review of FSs and Records of Decision for approximately 149 sites, is containment of the landfill contents and collection or treatment of landfill gases. In addition, measures to control landfill leachate or affected groundwater may be required on a site-specific basis.

In accordance with the presumptive remedy approach, the alternatives presented in the FS and summarized below have been directed toward containment of the landfill wastes and evaluation of the measures to address leachate and groundwater migration. The key components of the evaluated alternatives are identified in Table 13 and described in the following text.

Alternatives Summaries

Alternative 1: No Action

The no-action alternative is developed as a baseline case, as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The only activities conducted under this alternative are monitoring to evaluate contaminant migration and a review of Site conditions and risks every 5 years.

The purpose of this alternative is to evaluate the overall human health and environmental protection provided by the Site in its present state. Under this alternative, no remedial actions would be taken to protect human health and the environment. With contaminants present in the landfill's surface soils and subsurface materials and no measures implemented to prevent exposures, potential exposures to humans and biological receptors and contaminant migration would continue unabated.

Because no actions would be conducted under Alternative 1 to maintain or cover the landfill, the landfill surface will continue to erode and expose more contaminated materials and allow greater potential exposures, increased infiltration and attendant contaminant leaching and migration, and transportation of all surficial materials through precipitation and wind erosion. Under the no-action alternative, contaminants will continue to migrate unabated.

TABLE 13
DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES
BERKLEY PRODUCTS, PENNSYLVANIA

	ALTERNATIVE	KEY COMPONENTS OF ALTERNATIVE
1	No Action	• Groundwater, residential well, surface runoff, leachate spring and seep monitoring (every 5 years). • Five-year reviews.
2	Limited Action with Institutional Controls	• Fencing. • Institutional controls. • Groundwater, surface runoff, leachate spring and seep monitoring (annual), residential well monitoring (semi-annual). • Five-year reviews.
3	Consolidation, Capping, and Institutional Controls	• Pre-design investigations. • Site preparation. • Consolidation of landfill wastes. • Site grading. • Cover system - Subgrade - Gas vent system - Barrier layers - Drainage layer - Top layer (vegetated) • Security fencing. • Erosion control. • Institutional controls. • Long-term operation and maintenance. • Groundwater, surface runoff, leachate spring and seep monitoring (annual), residential well monitoring (semi-annual) and monitoring wells (quarterly). • Five-year reviews.

Since contaminants remain on the Site, a review of Site conditions and risks would be conducted every 5 years, as required by CERCLA. The reviews would consist of evaluation of analytical and hydrogeologic data, assessment of whether contaminant migration has increased, and determination as to whether human or biological receptors or natural resources are at risk.

Alternative 2: Limited Action with Institutional Controls

The limited-action alternative would include the construction of a fence to restrict access to the landfill and institution of deed restrictions and local ordinances to prevent future uses of the property that could result in additional exposures and to prevent the use of groundwater from under the Site. Long-term, semiannual monitoring would be conducted to assess contaminant status and potential threats to human health and the environment.

As in Alternative 1, Site conditions and risks would be reviewed every 5 years since wastes are left in place. Under this alternative, no actions would be taken to reduce the toxicity, mobility, or volume of contaminants at the Site. With contaminants present in the landfill's surface and subsurface, contaminant migration would continue unabated.

Alternative 3: Consolidation, Capping, and Institutional Controls

Alternative 3 is a containment option that would utilize capping to prevent potential human and animal contact with contaminants in soils and landfill materials and significantly limit contaminant leaching into groundwater, thereby reducing contaminant migration.

Prior to the remedial action implementation, a topographic survey and a geotechnical engineering study would be conducted to obtain data necessary to design and construct the cover system. Based on the results of these pre-design studies, the design of components of the cover system for the landfill, as listed in Table 13, may be modified to more appropriately address Site-specific conditions. After data collection is completed and design is underway, Site preparation would commence. The Site would be cleared of vegetative growth to facilitate capping. Leachate sediments and materials end-dumped over the southern edge of the landfill and currently located at the toe of the hillside would be consolidated back into the main portion of the landfill. The consolidated soils and landfill materials would then be compacted and graded to achieve desired slopes. The various layers of the low-permeability cover system, including a passive gas collection and venting system, would then be placed. Institutional controls (e.g., deed restrictions and ordinances) would be required to prevent damage of or intrusion into the cover system, as well as prohibit the installation of new residential wells in contaminated portions of the aquifer. During consolidation activities, it may be determined necessary to excavate uncovered wastes (e.g. drums) and arrange for off-site disposal.

This alternative also provides for security fencing during active cap construction, erosion control, and a long term operation and monitoring program that will incorporate residential well sampling twice a year and monitoring well sampling quarterly. Surface runoff, leachate and spring samples will also be taken on a yearly schedule.

The monitoring well program will include new monitoring wells that will be installed at locations and depths between the landfill and downgradient residents. These wells will be installed to act as early warning wells ensuring that any changes to the groundwater conditions will be made known well in advance of the potential for any residential wells being contaminated. These new wells, in conjunction with the existing monitoring wells and the residential wells, will serve to show any changes to the groundwater quality in the surrounding area as well as to identify any potential for contamination to spread in the future.

Alternative 3 was originally developed and presented in the Feasibility Study for this Site. Upon review of that document and in consideration of preliminary comments, this alternative was modified to include an upgraded cap system that would conform to the requirements for a hazardous waste landfill, as opposed to the capping requirements for a municipal waste landfill. A "hazardous waste cap" is similar to a "municipal waste cap" except that an additional impermeable layer is included. Other components of this alternative originally introduced as being pursuant to the municipal waste landfill regulations, have been revised to reflect adherence to the analogous state hazardous waste landfill regulations.

Since contaminants will remain on Site, long-term monitoring and 5-year reviews would be required to assess contaminant status and evaluate whether residential wells may have been affected. The number and frequency of the samples and parameters for analysis will be evaluated for continued suitability during the 5-year reviews.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

EPA uses nine criteria, described in CERCLA at Section 121(b)(1), 42 U.S.C. §9621(b)(1) and the National Oil and Hazardous Substances Contingency Plan (NCP), 40 C.F.R. Part 300.430(e)(9) to evaluate remedial alternatives. These criteria include the statutory requirements of Superfund as well as other technical, economic and practical factors used to assess the feasibility and acceptability of alternatives. The nine criteria are listed below, divided into three groups:

A. Threshold Criteria
1. Overall protection of human health and the environment
2. Compliance with "Applicable or Relevant and Appropriate Requirements" (ARARs)

B. Primary Balancing Criteria
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost

C. Modifying Criteria
8. State Acceptance
9. Community Acceptance

Alternatives must meet the threshold criteria before they are evaluated in any further detail. The primary criteria are then used to compare benefits among the alternatives that pass the threshold tests. The final considerations in the selection process include comments from the public and the Pennsylvania Department of Environmental Protection.

Analysis Against The Nine Criteria

1. Overall Protection of Human Health & the Environment

A primary requirement of CERCLA is that the selected remedial alternative be protective of human health and the environment. A remedy is protective if it reduces current and potential risks to acceptable levels.

Alternative 1, No Action, would not provide long-term protection of human health and the environment. Contaminants within the soils and landfill materials would not be remediated or isolated and would continue to pose risk. Under current conditions, direct human exposure to Site surficial soil poses an estimated carcinogenic risk of approximately 1E-4, which is the upper limit of EPA's acceptable risk range. Exposure to surficial soil is not expected to pose an unacceptable non-carcinogenic risk, as indicated by an HI of less than 1. However, over time, as soil erodes from the landfill surface, more contaminated subsurface materials may be exposed and become available for direct human contact, resulting in increased risks. The risk assessment estimated that contaminants are present at concentrations that may each pose carcinogenic risks greater than 1E-3, and an HI greater than 1 could result from human exposure to subsurface soils.

Because infiltration would continue to permeate the landfill, the contaminants remaining in landfill soils would continue to leach into the groundwater and thereby continue to potentially affect downgradient portions of the aquifer (including private residential wells), leachate seeps, and Cocalico Creek. The seeps and springs at the base of the landfill would continue to discharge contaminated groundwater to the surface and continue to drain into Cocalico Creek.

The ecological risk assessment shows that, under current conditions, the potential exists for impacts to ecological receptors resulting from contact with Site surface soils and leachate seeps. As the landfill surface erodes and more contaminated subsurface soils become exposed, potential ecological risks would be expected to increase.

Subsequently, the No Action alternative does not meet this threshold criteria and is not considered further in this comparative analysis.

In Alternative 2, the fencing and institutional controls proposed under the limited action alternative would provide limited protection of human health by restricting human access to contaminated media. This alternative would not be protective of the environment or most ecological receptors.

Because this alternative includes no controls to prevent deterioration of the landfill surface over time, surface soils would erode, causing the more contaminated subsurface soils to be exposed. Direct human contact with these soils would pose increased carcinogenic and non-carcinogenic human health risks. The estimated future risks posed by direct contact with subsurface soils exceed a carcinogenic risk of 1E-3 and a non-carcinogenic HI of 1. Fencing the landfill area would provide some protection from human exposure to these soils. However, fencing is not likely to prevent all human access to the Site. Deed restrictions and local ordinances, if enforced, would limit future use of the Site, deter intrusion into contaminated soils, and restrict use of Site groundwater.

The long-term impacts to the ecological receptors and the environment would remain unchanged under this alternative. Because landfill materials would not be remediated or covered, contaminated surface soils would continue to migrate off Site in wind and surface runoff.. The contaminants remaining in landfill soils would pose potential risks to plants and animals and would continue to leach into the groundwater. Fencing would have little influence on the protection of ecological receptors; large mammals may be barred from the Site by the fencing, but small burrowing mammals, birds, and invertebrates would be unaffected. Exposure to Site contaminants could still occur through ingestion, direct contact, and the food chain. The contaminated groundwater emanating from the Site would continue to potentially affect downgradient portions of the aquifer and Cocalico Creek and would continue to discharge from seeps and springs at base of the landfill.

Alternative 2 also does not meet this threshold criteria and is not considered further in this comparative analysis.

Alternative 3 would provide short-term and long-term protection of human health and the environment by preventing direct exposure (dermal contact, incidental ingestion, and inhalation) to contaminated soils and landfill materials and minimizing contaminant migration from the landfill into the environment.

Consolidating and capping the contaminated soils and landfill materials would reduce human health risks posed by direct exposure to within EPA's acceptable risk levels (less than 1E-6 for carcinogenic risks and less than an HI of 1.0 for non-carcinogenic risks). The cover system, which includes a biotic barrier to prevent animal intrusion into the barrier layer and waste materials, would also reduce the ecological risk posed by contaminated soils to acceptable levels.

The cover system would significantly reduce infiltration of precipitation into the landfill, thereby greatly reducing contaminant leaching from the soil and landfill materials to the underlying groundwater. Because the contaminated soils and landfill materials are situated above the water table, reducing the contaminant leaching caused by infiltration would ultimately result in a decrease in contaminant concentrations in groundwater beneath the landfill and a decrease in off-site migration of contaminants in groundwater. The potential risks to downgradient users of the aquifer, as well as to ecological receptors that could be exposed to Site groundwater discharging from spring and seep locations, would be reduced by implementation of this alternative.

Deed restrictions, and local ordinances would provide additional long-term protection by limiting access to the capped area and restricting activities that could damage or intrude into the cover system and contaminated media.

The long-term monitoring program would allow the responsible agency to monitor the quality of groundwater leaving the Site, assess potential impacts to downgradient receptors (especially residential wells), and determine whether additional remedial actions are necessary.

Use of engineering controls to minimize generation of fugitive dusts and vapors, and proper use of PPE by Site workers would effectively minimize short-term risks to the local community and workers posed by implementation of this alternative.

2. Compliance with ARARs

Under Section 121(d) of CERCLA, 42 U.S.C. Section 9621(d), and EPA guidance, remedial actions at CERCLA sites must attain legally applicable or relevant and appropriate federal and promulgated state environmental standards, requirements, criteria, and limitations (which are collectively referred to as "ARARs"), unless such ARARs may be waived under CERCLA Section 121(d).

ARARs fall into three general categories: chemical-specific, action-specific and location-specific. Chemical-specific regulations include those requirements that establish allowable concentrations or discharge limits specific to identified chemicals, such as Maximum Contaminant Limits (MCLs) under the Safe Drinking water Act or chemical-specific discharge limits developed under the National Pollution Discharge Elimination System of the federal Water Pollution Control Act. Action-specific requirements include municipal and hazardous waste disposal requirements of RCRA and authorized regulations of the Commonwealth of Pennsylvania, safety and construction regulations, and other regulations related to the action being taken. Location-specific regulations include those that deal with archeological or historical aspects of the Site area as well as endangered species that may be located within or near the Site; there are no location-specific ARARs identified for the Berkley Products Superfund Site.

Alternative 3's compliance with federal and state requirements is summarized in the following paragraphs.

Federal requirements - Alternative 3 would comply with RCRA 40 CFR §264.310 (a) since a final cover system would be installed over the landfill. Alternative 3 would also comply with the requirements for post-closure care (40 CFR §264.310 (b)) through the long-term maintenance and repair program. Long-term monitoring requirements (40 CFR §258.60) would be met through the sampling and evaluation of groundwater, springs and seeps, and residential wells.

Alternative 3 would be consistent with the TSCA PCB storage and disposal regulations applicable to the disposal of PCBs at concentrations greater than 50 ppm, because the soils and landfill materials would be contained by a cover system in accordance with 40 CFR §761.75. However, the following requirements will be waived pursuant to requirements found at §761.75 (c) (4): construction in low-permeable clay conditions [40 CFR §761.75 (b)(1)]; use of a synthetic membrane liner [40 CFR §761.75 (b)(2)]; requirements for no hydraulic connection between the Site and flowing surface water and the height of the bottom of the landfill above the historic high water table [40 CFR §761.75 (b)(3)]; and installation of a leachate collection system [40 CFR §761.75 (b)(4)]. Waivers are allowed if evidence is presented that the operation of the landfill will not present an unreasonable risk of injury to health or the environment from PCBs. At the Site, current risks from exposure to PCBs in surface soil fall within EPA's acceptable risk range. PCBs were not detected in residential wells and even the levels detected in monitoring wells immediately adjacent to the site would not generate an unacceptable risk. However, exposure to the highest level of PCB in sub-surface soil determined during the test-pitting operations would generate a hazard Index of 140 if this route of exposure were available. Capping of the landfill would eliminate the potential for direct contact exposure to PCBs form the Site as well as eliminating the percolation of rainwater through the landfill materials, the driving force for potential PCB migration to the groundwater. The above specified requirements of TSCA are therefore waived.

The alternative would be consistent with the OSWER Directive No. 9335.4-01, which directs action toward containment remedial actions.

Under §300.430 (f) of the NCP, ARARs may be waived if "The (selected) alternative will attain a standard of performance that is equivalent to that under the otherwise applicable standard, requirement or limitation through use of another approach". At the Berkley Products Site the attainment of Maximum Contaminant Levels (MCLs) enacted under the Safe Drinking Water Act, 42 U.S.C. §§300 f to 300 j-26, are considered to be Relevant and Appropriate standards; however, for this remedy they will be waived under this provision of law for the following reasons:

> The residential wells surrounding the Site are not currently contaminated with Site-related contamination. This is because the rock strata are naturally aligned so as to direct any leaching contamination downward at such a steep angle that any potentially contaminated groundwater is rapidly removed from surface availability.
>
> The capping of the landfilled area will eliminate or severely reduce the infiltration of rainfall, which is the main driving force behind the production of leachate and migration of contaminants.
>
> The monitoring program as envisioned would install new wells that will serve to further characterize the aquifer beyond the perimeter of the Site and monitor the concentrations in the groundwater of any Site-related contamination. These wells will also serve to indicate the effectiveness of the cap in reducing the migration of contaminants.
>
> Because hazardous substances remain on-site, reviews of the remedy will be conducted at least every five years. These "Five-Year Reviews" will utilize the information gathered in the

monitoring program to confirm that no resident is subject to unacceptable Site-related risks and ensure that the remedy remains protective of human health and the environment. Five-Year Reviews can also trigger further response actions if unacceptable risks are discovered.

In view of the above paragraphs, this alternative will attain an equivalent standard of performance to that achieved by attainment of MCLs. Therefore the requirement for attainment of MCLs is waived.

State requirements - Alternative 3 would comply with the specific provisions of the state hazardous waste regulations PA Code §624, set forth below, because a final cover system would be installed and closure and post closure activities will be implemented. Specifically, during the construction of the cover system, measures would be implemented under Alternative 3 to comply with the relevant and appropriate state hazardous waste landfill regulations concerning closure and post-closure activities found at §264.111, §264.112, §264.114, §264.117 and §264.118, as well as the design requirements and construction of the cap, §264.301, §264.310 and those requirements of §264.302 that are specific to the cap construction and operation. Groundwater monitoring requirements under §264.97 and §264.98 will be met by the monitoring program. As the landfill is no longer active, the security requirements under §264.14 will be followed through completion of the construction of the cap, however the requirement for an artificial barrier required under §264.14(b)(4) may be substituted with natural barriers, such as hedges surrounding the landfilled portion of the Site. Currently there are steep forested inclines surrounding three sides of the landfill; these may be utilized in combination with other natural or artificial measures such as locking gates at the entrance to the landfill to provide security and control vehicular access. The components to be used as barriers will be decided in the design phase of the project. During active construction a temporary fence will be installed to provide the security for the period when waste may be exposed and construction equipment present.

Alternative 3 would implement measures to control fugitive dusts in compliance with PA Code 25 §123.1(c). If objectionable odors are identified after completion of the remedial action, an active gas vent and treatment system would be installed and operated in compliance with PA Code 25 §123.31. Emissions from an active system would have to meet the relevant and appropriate requirements of PA Code 25 §127.1 and §127.11.

Measures to minimize soil erosion and sedimentation that may result from Site consolidation, grading and contouring activities would conform with PA Code 25 §§102.2 through 102.24 to prevent the potential pollution from surface wastes. An erosion and sedimentation control plan would be prepared, submitted for approval, and implemented upon approval. Stormwater runoff management during the cover system construction would be consistent with the county watershed management plan's construction criteria, per the state Storm Water Management Act.

3. Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence addresses the long-term protection of human health and the environment once the remedial action goals have been achieved. This comparison focuses on the residual risk that will remain after completion of the remedial action and the adequacy and reliability of controls used to manage the untreated waste and treatment residuals.

Capping of contaminated soils would reduce the human health risk posed by direct exposure to contaminated soils and landfill materials to within EPA's acceptable risk range (less than 1E-6 carcinogenic risk; the HI would be reduced to less than 1.0). The cover system, which includes a biotic barrier to prevent animal intrusion into the barrier layer and waste materials, would also reduce the ecological risk to acceptable levels by inhibiting access to contaminated soils. By greatly reducing the leaching of contaminants to groundwater and the subsequent downgradient migration of contaminants, capping would also reduce the potential risks to downgradient users of the aquifer, as well as to ecological receptors that could be exposed to Site groundwater discharging from spring and seep locations.

Because contaminated soils and landfill materials would remain in place beneath the cover system, long-term maintenance of the cover system and natural or artificial perimeter boundaries and adequate enforcement of institutional controls would be required to ensure the long-term protectiveness of this alternative. Routine maintenance and repair of the cover system would be required to ensure that the effectiveness of the cap as a barrier is maintained.

The annual monitoring of groundwater, leachate seeps and springs, and residential wells would allow the responsible agency to monitor the quality of groundwater leaving the Site, assess potential impacts to downgradient receptors (especially residential wells), and determine whether additional remedial actions are necessary. The monitoring program, in combination with the cover system, should be effective in minimizing the risks to downgradient receptors.

Five-year reviews would be required to assess whether the cover system continues to be effective in preventing direct exposures and reducing contaminant leaching. These reviews would be based in large part on analytical data collected during annual monitoring events. Review of the effectiveness of deed restrictions and ordinances in preventing damage to the cover system and exposure to Site contaminants would also be required.

No difficulties or uncertainties are anticipated in performing the long-term maintenance or monitoring. All materials used in construction of the cover system, fencing and barriers are readily available and can be replaced. In the event of damage to the cap system, repairs could be performed without many difficulties. Groundwater monitoring wells would require replacement if sedimentation or vandalism were to occur; the wells would be readily replaceable.

Because maintenance of the cover system would be continual, catastrophic failure is unlikely. In the event of failure or damage of the cover, existing access restrictions, institutional controls, and monitoring would be expected to provide adequate short-term protection of human health until the cover system was repaired.

<u>4. Reduction of Toxicity, Mobility, or Volume Through Treatment</u>

This evaluation criteria addresses the degree to which a technology or remedial alternative reduces toxicity, mobility, or volume of hazardous substance at the Site. Section 121(b) of CERCLA, 42 U.S.C. Section 9621(b), establishes a preference for remedial actions that have as a principal element treatment that permanently and significantly reduces the toxicity, mobility, or volume over remedial actions which would not.

Alternative 3 would not reduce the toxicity, mobility, or volume of contamination through treatment because no treatment is used to address the contaminated soil and landfill materials. However, mobility of contaminants from the soil and landfill materials would be minimized by the cover system. The chemicals in the soil and landfill materials and underlying soils would not be treated or destroyed and would remain at the facility. Alternative 3 would not satisfy the statutory preference for treatment to reduce risks posed by contaminated soil and landfill materials.

5. Short-Term Effectiveness

This criteria refers to protection of workers and the community, the potential environmental effects of the remedial action, and the time needed to implement the proposed activity. Implementation of Alternative 3 is not expected to pose any significant risks to the local community. Increased truck and heavy equipment vehicular traffic would occur as the result of Site preparation and the import and placement of capping materials. Coordination and scheduling of truck and heavy equipment traffic on public roads would be required to manage increased vehicular activity.

During Site preparation and placement of the cap system, risks posed by fugitive dust (bearing adsorbed contaminants) to off-site residents would be minimized by appropriate engineering control measures such as dust suppressants. Workers who implement Alternative 3 would be adequately safeguarded by using appropriate personal protective equipment (PPE) to prevent exposures to contaminated soils and landfill materials, contaminant-laden dusts, and airborne VOCs. OSHA standards would be followed and proper PPE would be used during all remedial activities.

No permanent adverse impacts to the environment are anticipated to result from construction of the cap system. Erosion control measures such as hay bales and silt fences would be used to prevent damage to the environment from sediment runoff. Following excavation of landfill wastes from the southern hillside slope, this area would be stabilized to prevent erosion.

The cap system placement would require approximately 18 months to implement, including pre-design and design activities. Upon completion of the cap, Alternative 3 would achieve the RAO for protection of human health by preventing exposure to contaminated soils and the RAO for minimizing leaching of contaminants. Deed restrictions and local ordinances may take a year or longer to implement, depending on the level of cooperation by Site owners and municipal officials.

6. Implementability

This evaluation criteria addresses the difficulties and unknowns associated with implementing technologies, the ability and time necessary to obtain required permits and approvals, the availability of services and materials, and the reliability and effectiveness of monitoring. Alternative 3 is implementable. No anticipated difficulties or uncertainties exist in consolidating landfill wastes and constructing the cover system because only common construction techniques are required.

Long-term monitoring (sampling and analyses) only requires readily available resources. Deed restrictions and ordinances may or may not be difficult to implement and enforce, depending on the level of cooperation by Site owners and municipal officials.

Since long-term monitoring is included under Alternative 3, contaminant presence and migration could be assessed. Monitoring of groundwater would be effective for detecting changes in groundwater quality that may indicate landfill failure and for identifying potential impacts to downgradient receptors.

Permits would not be required under Alternative 3 because all activities would be conducted on the Site; however, the substantive requirements of all ARARs would be met as described previously. Permits for the ultimate discharge of storm water runoff to off-site locations may be required. Coordination with other agencies may be required for the five-year review process and for implementation of local ordinances. Coordination with the property owner would be required to implement deed restrictions.

There are ample companies with the trained personnel, equipment, and materials to perform Site preparation, construct the cover system, install fencing, and perform maintenance and long-term monitoring. Regulatory personnel and environmental specialists are readily available to perform effective 5-year reviews.

7. Cost

CERCLA requires selection of a cost-effective remedy that protects human health and the environment and meets the other requirements of the Statute. The capital costs for Alternative 3 total $4,336,000. The average annual O&M costs are $306,200, and 5-year reviews cost $28,000 per event. Over a 30-year period, the net present worth cost is $8,200,000 (at a seven percent discount rate).

8. State Acceptance

PADEP has been consulted throughout the investigation of the Berkley Products Site and supports the selection of Alternative #3 as the Preferred Alternative.

9. Community Acceptance

The Proposed Plan was available for public review and comment from April 8, 1996 to May 4, 1996. A public meeting for the Proposed Plan presenting Alternative #3 as the Preferred Alternative was held on April 17, 1996, at the West Cocalico Township Building.

Four written comments were received during the comment period. Oral comments were accepted at the public meeting and a transcript of that public meeting is included in Attachment 1 of this Record of Decision, the Responsiveness Summary. The significant comments are summarized and addressed in this attachment.

IX. SELECTED REMEDY

Based on consideration of the information available for the Berkley Products Site, including the documents available in the administrative record file, an evaluation of the risks currently posed by the Site, the requirements of CERCLA, the detailed analysis and comparison of evaluated alternatives and public comments received, EPA has selected **Alternative 3, Consolidation, Capping and Institutional Controls** as the remedy to be implemented at the Berkley Products Site.

As described in the description of Alternative 3, the selected remedy, shall include the following components:

- Pre-design investigations,
- Site preparation,
- Consolidation of landfill wastes,
- Site grading,
- Cover system consisting of Subgrade, Gas vent system, Barrier layers, Drainage layer and Top layer (vegetated),
- Security fencing,
- Erosion control,

- Institutional controls,
- Long-term operation and maintenance,
- Groundwater, surface runoff, leachate spring and seep monitoring (annual), residential well monitoring (semi-annual), and
- Five-year reviews.

X. PERFORMANCE STANDARDS

Pre-Design Investigations and Activities

Prior to the remedial action implementation, a topographic survey and a geotechnical engineering study will be conducted to obtain data necessary to design and construct the cover system. Potential subsidence of the landfill materials and soils will need to be investigated to estimate settling rates in different areas of the landfill and whether actions would be required to minimize future problems associated with differential settlement. Differential settling could damage the cover system and promote possible human and animal exposures and contaminant migration. The geotechnical investigation may include load tests in discrete portions of the landfill to identify the rate of waste materials consolidation under loading. The load test data could be used in the cover system design; however, test results may not provide reliable information for the entire landfill, which is very heterogeneous. Alternatively, the waste materials may be surcharged, causing settlement, so that future settling is minimized. After settlement has reached the desired goal based on field observations, the surcharge materials could be used as the subgrade for the cap system.

Borings, sampling, and analyses may be required as part of a pre-design investigation to more fully delineate the extent of the landfill materials on the plateau of the hill, the extent of landfill materials east of the plateau, and the thickness and extent of materials on the southern slope of the landfill. This information is necessary to design the cover system and refine estimates of the volume of materials to be removed from the southern slope. Additional soil gas sampling may also be needed to assess the types of soil gases present and whether there are gas pockets. This information can assist in the gas vent layer design.

A topographic survey of the Site will be performed so that survey results can be used in the cover system design. A traffic management plan will need to be developed and submitted to the Pennsylvania Department of Transportation (PennDOT) for review and approval.

Site Preparation

During all phases of the site activities, preparation through construction and maintenance, erosion and sedimentation control measures will be taken in accordance with PA Code 25 §§102.2 through 102.24.

The Site has been unused for a number of years and is heavily overgrown by vegetation. Site preparation will require the clearing and grubbing of the vegetative growth that currently covers much of the landfill. The central portion of the landfill appears to have been cleared of trees and large brush in the past, and only low-lying bushes and grasses are present. The perimeter of the landfill (east of the plateau) has a number of trees that may need to be cleared so that the cap can cover all waste materials and debris. The southern slope of the Site will need to be cleared of trees and vegetative growth so that debris, landfill materials, and possibly contaminated soils could be removed by excavators for consolidation back into the landfill.

Silt fences, staked hay bales, or other appropriate measures will be required to minimize erosion effects while the trees and vegetation are being removed. Silt barriers will be placed at the perimeter of the level portions of the landfill and at the toe of the landfill area to prevent silt and soil movement to downslope areas and properties.

Site utilities will need to be established prior to the start of Site remediation. Electric and telephone lines are available along Wallups Hill Road, which abuts the landfill property. Water will have to be obtained from an off-site source for dust-control purposes. Filled tankers could be brought on Site and the water could be used as needed.

Staging areas will be established to stockpile cover system materials, temporarily excavated soil and landfill materials, or equipment. Construction of access roads may be required to support the anticipated truck and heavy equipment traffic and to prevent erosion, per PA Code 264.301(1). Fencing will be installed at key entry points (roads, large open areas) to limit unauthorized access to the Site during construction.

<u>Consolidation</u>

An estimated 18,056 cubic yards of materials (contaminated soils and leachate sediments and the landfill materials that had been end-dumped from trucks) are deposited on the southern face of the hillside. Once the southern slope is cleared and grubbed, the soils and materials will be excavated using truck-mounted dragline excavators, power shovels or other appropriate equipment. Because of the steep slopes, the safest positioning of heavy equipment would be on the relatively level portions of the landfill (plateau area). The excavated materials would be lifted to the level portion of the landfill and emptied into dump trucks or temporary stockpiles. The excavated materials would then be dumped or backfilled on the landfill, graded, and compacted.

As necessary, engineering controls will be implemented during consolidation and backfilling to prevent airborne emissions of fugitive dusts in accordance with PA Code 25 §123.1(c). Temporary covers may be applied to soils and landfill materials storage areas, and dust suppressants and water would be applied to wet down materials, as appropriate, to minimize fugitive dust emissions. The delineation of <u>actual</u> areas to be addressed and the quantities to be consolidated and compacted will be made after evaluation of the results of the pre-design investigation.

<u>Site Grading</u>

After the soils and landfill materials from the hillside are consolidated at the landfill, grading will be required prior to placement of the cover system. Compaction and grading of the soils and landfill materials will be performed as needed to conform to the requirements specified in §264.301 (5) and §264.301(6). The appropriate slopes for the base of the cover (to facilitate drainage) will be determined as part of the cover system design.

<u>Cover System Placement</u>

A low-permeability cover system will be designed and installed to prevent human and animal exposures to soil and landfill material contaminants and to minimize infiltration and resulting organics and metals leaching into groundwater. The cover system will be designed and installed in accordance with the sections of the Commonwealth of Pennsylvania Hazardous Waste Regulations PA Code, Title 25, Article VII, Chapter 264 specified below.

For the purpose of this analysis, a composite multi-media cover system is described as the likely representative capping option. The exact design of the landfill capping system may be modified during design to address Site-specific features. The cover system will be installed over the entire 5 acre landfilled area of the Berkley Products Site. Descriptions of the individual cover layers are summarized as follows from bottom to top:

Subgrade - The base layer of the cover system conforming to §264.302 (a)(6) should be a well-compacted and smooth surface of sufficient thickness to prevent puncture of the barrier layer by landfill materials. The subgrade may be a well-graded sand and gravel. A geotextile material may be used above the subgrade to separate the sand and gravel from the gas vent layer.

Gas Vent System - The objective of this layer is to vent methane, carbon dioxide, hydrogen sulfide, and other VOCs to the ambient air. Without provision for venting, the placement of a low-permeability barrier over the landfill materials could cause accumulation of undesirable soil gases that could permeate upward and disturb the cover system or migrate laterally outside landfill boundaries. The gas collection/venting layer will conform to 25 §264.301(12) and may be made of gravel, coarse sand, or geosynthetic materials. During design, it will be determined whether an active gas venting system, with a blower and appropriate pollution control device (e.g., flare, biofilter, activated carbon, etc.), is necessary or if a passive vent system will be adequate.

If passive venting system is installed, landfill gases will be monitored (periodically, following completion of the cover system) to ensure that the passive gas collection system is adequately controlling gas emissions. If problems such as landfill gas migration or excess odors are detected, then an active vapor collection system may be warranted to control gas emissions. A passive venting system will be designed to be easily modified to an active system. Treatability testing would be required to design an active vapor control system to effectively manage the landfill gases.

Barrier Layers - These layers will be designed to minimize precipitation infiltration into the underlying soils and landfill materials and will conform to §264.302 (a)(6) . A minimum of 2 foot of compacted clay or a geomembrane of at least 50 mil thickness will be used for each layer. The clay or the geomembrane barriers will have a maximum permeability of 1×10^{-7} cm/s.

It is likely that geomembranes will be selected as the appropriate barrier layers for this landfill. Geomembranes can be installed more efficiently than a compacted clay layer. The geomembrane may be a flexible membrane liner (FML) composed of low-density synthetics for tolerating subsidence-induced strains.

Drainage Layer - A drainage layer conforming to §264.302 (a)(6) will be installed to prevent the accumulation of water above the barrier layers. Ponded water could damage the geomembrane or cause erosion of the top layer. The drainage layer will promote the removal of water to areas outside the cover. The drainage layer can be a geosynthetic material or coarse sand/gravel (less than 3/8"). A geotextile filter fabric may be placed over the drainage layer to prevent the entry of fine-grained particles into the drainage layer. Precipitation infiltration that reaches this layer will be channeled to a toe drain and would ultimately be discharged to Cocalico Creek.

Top Layer - The objective of this layer is to protect the cover from erosion by rain or wind and from burrowing animals. A minimum of 2 feet of uniform, compacted soil conforming to PA Code 25 §264.310 (1) will be placed over the drainage layer. A biotic barrier layer (5 to 10 inches) comprised of stones or cobbles may be installed under the compacted soil layer to prevent animal intrusion into the cover or underlying waste materials.

The final surface slope of cover system in the plateau area shall have a slope of not less than three percent (3V:100H), but not exceeding 15 per cent, per PA Code 25 §264.301 (5), to ensure slope stability control erosion, and allow compaction, seeding, and revegetation of the cover materials. A final slope in excess of 15 percent is allowable if horizontal terraces are at least 10 feet wide for every 20 feet maximum rise in elevation of the slope. The terrace would be sloped one percent into the landfill. The final slope would also promote precipitation runoff while inhibiting erosion or infiltration. The slope of the cover system in the plateau area will be approximately five percent, which conforms to the existing topographic grade. It is anticipated that the cover system in the eastern portion of the landfill would have a final slope of about 20 percent (20V:100H). It is also expected that two terraces will be constructed (10 feet wide minimum) at an approximate 20 foot change in elevation. A 20 feet change was assumed so that the terraces would be more evenly spaced on the eastern slope of the landfill.

Surface run-on and run-off controls will be required, given the large surface area the cover system is anticipated to encompass. Surface runoff will be channeled, via drainage swales or trenches, to surface drains, located on the perimeter of the cover system, and ultimately discharged to Cocalico Creek. The cover system will be designed to manage surface water and control soil erosion and sedimentation based on a 24-hour precipitation event for a 25-year storm, per PA Code 25 §264.301(8).

In accordance with PA Code 25 §264.310(4), the top layer will be vegetated with permanent plant species (excluding trees, woody shrubs, or deep rooted plants) to minimize erosion and soil loss of the final cover.

Final determination of the materials to be used in the cover system will be determined during the engineering design. The capped area is expected to encompass all contaminated soils and landfill materials. Routine maintenance and repair of the cover system will be required to ensure its long-term effectiveness.

Security Fencing

During construction, security fencing will be installed to deter or prevent unwanted human and animal entry into the landfill area, in accordance with PA Code 25 §264.14(b)(4). Permanent security barriers, either natural or artificial, or a combination, will be determined during design.

Removal Actions

If, during the consolidation, grading and capping activities, it is determined necessary to remove materials from the Site, all excavation, handling, transportation and disposal activities will be conducted in compliance with all state and local laws to the extent not inconsistent with federal laws.

Erosion Control

Erosion control measures will be taken during consolidation, grading and construction activities. After contaminated soils and landfill materials have been removed from the southern hillside slope, this area will be stabilized to prevent erosion. Measures such as planting new vegetation or placing rip-rap will be taken to minimize erosion effects. The slope may be graded or terraced to reduce the grade, thereby minimizing surface water runoff that may erode the hillside. All actions taken will be in accordance with PA Code 25 §§102.2 through 102.24.

Long-Term Monitoring

The groundwater monitoring program will be designed to meet the requirements of §264.97 and §264.98. The groundwater, surface runoff, and springs and seep leachate will be sampled to monitor the quality of groundwater leaving the Site and assess the potential impacts to downgradient areas. It is anticipated that the cover system will greatly reduce precipitation infiltration into the landfill, resulting in reduced leaching of chemicals into groundwater. The frequency of monitoring and the number of wells and analytical parameters may be decreased if the 5-year review determines that significant contaminant leaching reduction or improvement of groundwater quality has been attained.

Groundwater samples will be collected quarterly from approximately five existing and ten new monitoring wells to be installed during the remedial action and analyzed for the list of chemicals identified in PA Code 25 §273.284 and for Site-specific contaminants. Water levels will be measured during each sampling round to compile data to more fully define the hydrogeology of the landfill and adjacent properties.

Initially, approximately 30 residential wells situated primarily downgradient of the landfill will be sampled semiannually for VOCs and annually for SVOCs, pesticides/PCBs, and metals. Current data suggest that the residential wells do not appear to be affected by Site contamination. The sampling results will be used to assess whether contaminated groundwater has affected drinking water supplies and whether additional remedial or removal actions would be necessary.

Stormwater runoff from the landfill will be sampled and analyzed annually for VOCs, SVOCS, pesticides/PCBs, and metals. It is anticipated that the discharge will be sampled during one storm event.

The monitoring program will be conducted for the purpose of assuring that unacceptable risks do not develop in the future. The information generated in the monitoring program will be analyzed individually and collectively to identify trends. This information will be incorporated into the five-year review process to assure that the remedy remains protective of human health and the environment.

Institutional Controls

After the cover has been constructed, deed restrictions and local ordinances will be used to significantly limit the future activities that could result in intrusion into and possible damage of the cover and accidental exposure to the landfill wastes. Use of underlying contaminated groundwater as a potable water supply, without treatment, would be prohibited.

Operation and Maintenance

To ensure the proper functioning and protectiveness of the cover system, routine maintenance and repairs of the security barrier, runoff and drainage systems, gas vent system, and the cover system will be required. Routine mowing and repair of the cover will minimize the effect of erosion.

Five-Year Reviews

Since contaminants remain on the Site, a review of Site conditions and risks will be conducted every 5 years or less, as required by CERCLA. The reviews will consist of evaluation of analytical and hydrogeologic data developed in the monitoring program, assessment of whether contaminant migration has increased, and determination as to whether human or biological receptors or groundwater resources are at risk. If the monitoring program reveals unacceptable Site-related risks, such as exceedance of MCLs or risk based levels in the early warning monitoring wells, the Site will be evaluated and appropriate action will be taken. Exceedance of MCLs or risk based levels in the residential wells would be cause for provision of alternate water supplies. If it is determined that there is unacceptable risk to ecological receptors, further remedial actions will be evaluated.

XI. STATUTORY DETERMINATIONS

EPA's primary responsibility at Superfund sites is to develop remedial actions that achieve protection of human health and the environment. Section 121 of CERCLA, 42 U.S.C. §9621, also establishes several other statutory requirements and preferences for EPA to consider when selecting a Superfund remedy, including the following:

> The Selected Remedy must comply with applicable or relevant and appropriate environmental standards established under federal and state environmental laws, unless there are grounds for a statutory waiver.
>
> The Selected Remedy must be cost effective and should use permanent solutions, alternative treatment technologies and resource recovery methods, to the maximum extent practicable.
>
> CERCLA mandates a preference for treatment remedies that permanently and significantly reduce the volume, toxicity and mobility of hazardous wastes.

The discussion below describes how the Selected Remedy meets these statutory requirements and preferences.

A. Protection of Human Health and the Environment

The Selected Remedy protects human health and the environment by installing a cap system that will minimize the potential for direct contact with contaminated materials, the potential for infiltration and resultant contaminant leaching to groundwater and the potential for migration of contaminants off-site. The long-term groundwater monitoring program and five-year reviews will ensure that no resident is at risk of future exposure to contaminated groundwater.

B. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

As described in Section VIII, Summary of Comparative Analysis of Alternatives, and in Section X, Performance Standards, the Selected Remedy shall attain all action and chemical-specific ARARs identified for this Site. There are no location-specific ARARs identified for the Berkley Products Superfund Site.

The Commonwealth of Pennsylvania has identified The Land Recycling and Environmental Remediation Standards Act, the Act of May 19, 1995, P.L. 4, No. 1995.2, 35 P.S. §§ 6018.101 et. seq. ("Act 2") as an ARAR for this Site, however, EPA has determined that Act 2 is not an ARAR for the Berkley Products Superfund Site.

C. Cost Effectiveness

The selected remedy is cost effective because it has been determined to provide overall effectiveness proportional to its costs in reducing the risks associated with direct contact with contaminated materials and potential off-Site migration of contaminants.

D. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and alternative treatment technologies can be utilized while providing the best balance among the other evaluation criteria. The contaminated materials will be consolidated and capped in place, and the cap will be maintained through a long term Operation and Maintenance Program. This remedy provides the best balance of long-term and short-term effectiveness and permanence; cost; implementability; reduction in toxicity, mobility or volume of hazardous waste through treatment; state and community acceptance; and, the statutory preference for treatment as a principal element.

E. Preference for Treatment as a Principal Element

The Selected Remedy does not satisfy the statutory preference for remedies that employ treatment as a principal element to permanently reduce the toxicity, mobility or volume of hazardous substances. The Selected Remedy will not reduce the toxicity, mobility, or volume of contamination through treatment because no treatment is used to address the contaminated soil and landfill materials. The chemicals in the soil and landfill materials and underlying soils will not be treated or destroyed and would remain at the facility, however, mobility of contaminants from the soil and landfill materials will be minimized by the cap system.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES FROM PROPOSED PLAN

EPA reviewed all written and verbal comments received during the Proposed Plan Comment Period. Upon review of these comments, and especially the comments from the Commonwealth of Pennsylvania, it was determined that the landfill shall be closed pursuant to the state hazardous waste regulations specified in the Section VIII, Summary of Comparative Analysis of Alternatives and Section X, Performance Standards. The Proposed Plan for this Site indicated that the landfill would be closed pursuant to the relevant state municipal waste regulations but with the cap system to be designed to meet the higher standard of the hazardous waste regulations specification. Most of the remaining standards of the municipal waste regulations are analogous to the corresponding hazardous waste regulations and as such there is no significant change in the actual requirements for the remedy, but the appropriate legal citations have been substituted.

Additionally, the Proposed Plan included a permanent security fence to protect the landfill from unwanted human and animal entry. Following the evaluation of comments, this component of the remedy was modified to provide a temporary security fence which will provide security for the period when the waste will be exposed and construction equipment present; this temporary fence will be removed upon completion of construction. Appropriate components of a permanent security barrier, either natural (e.g. hedges) or artificial (Locking gates), or a combination, will be determined during design.